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TWO NEW SPECIES OF *TELEMIADES* AND NOTES ON SOME OTHERS (LEPIDOPTERA, RHOPALOCERA)

BY ERNEST L. BELL

A study of some of the members of the genus *Telemiades*, including *amphion* Geyer and several others having a somewhat similar superficial appearance, has resulted in establishing the identity of two or three rather obscure names applied to these insects by authors and in the discovery of two species not previously described. One name has been removed from the usual synonymy of *amphion* Geyer and restored to specific rank.

In this study much help has been given by Brigadier W. H. Evans in furnishing information in regard to Hewitson and Mabille types in the collection of the British Museum (Natural History).

All the specimens mentioned in this paper are in the collection of the American Museum of Natural History.

Reference to the venation of the wings by number, where it is given, follows the English system of numbering each vein from the lowest one upward.

Telemiades amphion amphion Geyer

Figure 1

Proteides amphion HÜBNER, 1819, p. 105. Manuscript name.

Proteides amphion GEYER, 1832, p. 12, figs. 631, 632 (Hübner, 1826, manuscript figures). West Indies.

Plesioneura compressa MÖSCHLER, 1876, p. 336, pl. 4, fig. 22. Surinam.

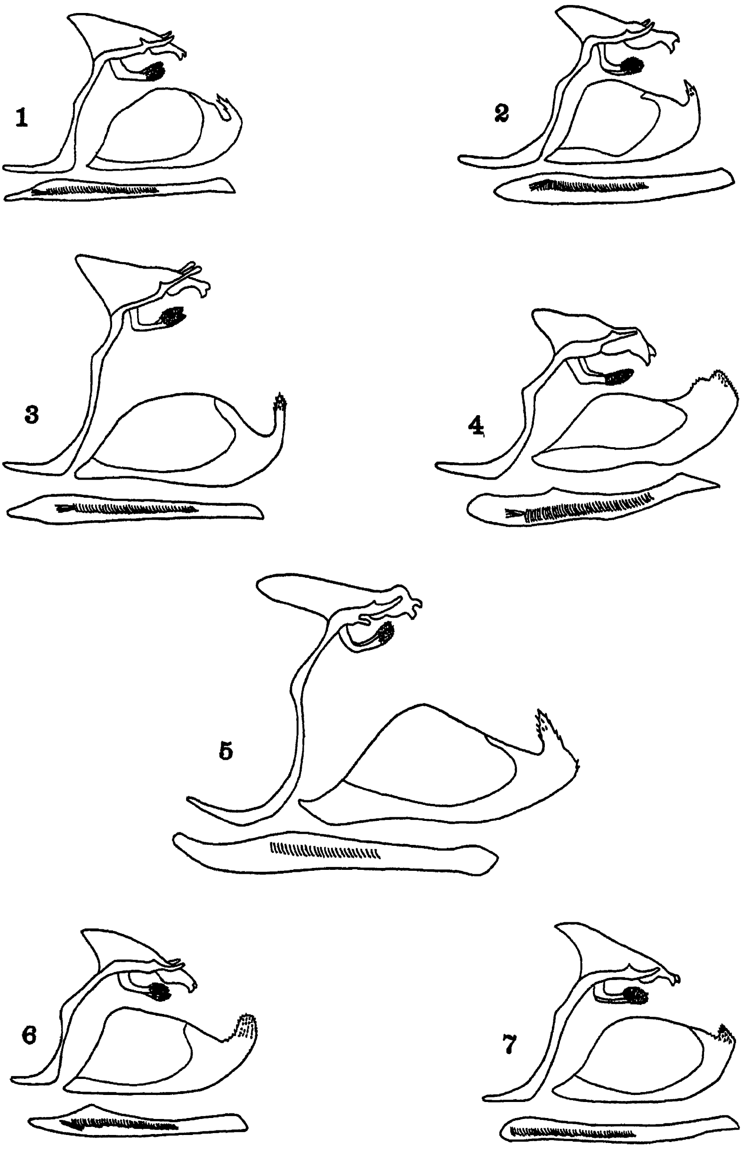
Proteides zethos PLÖTZ, 1882, p. 71. Para.

Proteides compressa, PLÖTZ, 1882, p. 71.

Aethilla buffumi WEEKS, 1906, p. 174. Suapure, Venezuela.

Telemiades zethos, GODMAN, 1907, p. 135.

Aethilla buffumi WEEKS, 1911, p. 26, pl. 18, fig. 1.



FIGS. 1–7. Male genitalia of Hesperiidae. 1. *Telemiades amphion* Geyer. 2. *Telemiades amphion misitheus* Mabille. 3. *Telemiades amphion marpesus* Hewitson. 4. *Telemiades antiope* Plötz. 5. *Telemiades brazus*, new species. 6. *Telemiades amphion* Geyer. (?Variant.) 7. *Telemiades fides*, new species.

The sex of the type of *amphion* was not stated in the original description, but the figure seems to be that of a male. The figure shows six moderately small white hyaline spots on each primary wing, of which two are subapical and four form a discal band, the one in the cell not being deeply excavated on its outer side.

The male *amphion* sometimes has three subapical spots, the third, and lowest, one always very small and lying below the outer corner of the spot above it. The cell spot is sometimes deeply excavated on its outer side. The spots of the discal band of the female are much larger than those of the male.

I have removed *antiope* Plötz from the synonymy of *amphion* where it has been placed by previous authors and have restored it to specific rank, for the reasons given on subsequent pages of this paper.

The specimens of *amphion* before me are from localities in Colombia; British, French, and Dutch Guiana; Perú; and Bolivia.

The male genitalia of *amphion* have a moderately short uncus, with a truncate apex having a short hook on each corner. On each side there is a rod-like structure attached to the tegumen, along the lower side of which these rods extend as far as the base of the uncus where they are angled, then curved forward and upward and are tapered to a narrow, rounded apex. There is a well developed scaphium. The apical arm of each clasper is directed upward and usually inclined a little backward, terminates in a sharp point, and carries a few short teeth. The aedeagus carries a long series of internal spines.

A single male specimen from British Honduras closely resembles *amphion* in superficial characters, but the genitalia (fig. 6) differ in that the terminal arm of each clasper is broader and apically rounded, not sharply pointed as is usual in *amphion*, and carries more numerous short teeth arranged in vertical rows. The other characters of the genitalia are as in *amphion*. Additional material is needed for study to determine whether the differences shown by this specimen are merely variations or are specific.

Telemiades amphion misitheus Mabille

Figure 2

Telemiades misitheus Mabille, 1888, p. 221, fig. 4 (not fig. 3). Chanchamayo.
Telemiades misitheus, Mabille and Boullet, 1912, pp. 113, 121.

The figure of the type of *misitheus* shows but one subapical white hyaline spot on each primary wing, but Mabille and Boullet say that there are three such spots in the specimens before them from Bolivia, Guiana, and Colombia. The specimens before me are two males from the vicinity of Baños, Ecuador; one has two subapical spots on each primary wing and the other has three, the lowest one being small and placed outward of the spot above it. In both specimens the uppermost subapical spot is the largest.

The male genitalia of *misitheus* do not appear to differ materially from those of *amphion*.

The male *misitheus* superficially differs from that sex of typical *amphion* in having much enlarged discal hyaline spots on each primary wing, similar to those of female *amphion*. The geographical range of *misitheus* seems to parallel closely that of typical *amphion*, and, lacking definite data, I am not sure of the exact relationship between the two forms. Perhaps *misitheus* may be merely a minor form of *amphion*.

Telemiades amphion marpesus Hewitson

Figure 3

Eudamus marpesus Hewitson, 1876, p. 354. Brazil.

Telemiades amphion, Draudt, 1922, pl. 168e.

Telemiades amphion, Hayward, 1933, p. 180, pl. 14, fig. 9 (not pl. 9, fig. 19, male genitalia).

On each primary wing of both sexes of *marpesus* the subapical and discal hyaline spots are extemely large. There are three subapical spots; the upper two are elongate, and the lowest one, though much smaller than the others, is well developed and lies directly under the middle of the spot above it. The dark bands of both primary and secondary wings are broad and continuous and stand out prominently in contrast with the rest of the wings. The outer margin of each primary wing is a little sinuous and that of each secondary wing is noticeably angled below vein 4. The size of *marpesus* is somewhat larger than that of typical *amphion*.

In the southern part of its range *amphion* is represented by *marpesus*.

The specimens at hand are from localities in the State of Santa Catharina, Brazil, and from Puerto Bertoni, Alto Parana, Paraguay.

The male genitalia of *marpesus* are very similar to those of *amphion*.

Telemiades amphion pekahia Hewitson

Pterygospidea pekahia Hewitson, 1868, p. 52. Venezuela.

The type of *pekahia* is a female. The original description states that there are eight white spots on each primary wing.

I have before me two specimens, a male and a female, from Mototan, Trujillo, Venezuela (P. J. Anduze). The female has the eight white hyaline spots as described by Hewitson. All the spots of the discal band are very much reduced in size in comparison with those of other members of the *amphion* group, the usual cell spot being represented by two small spots, thus accounting for the extra spot in the band. The male specimen has only three small white hyaline subapical spots on each primary wing, there being no trace of any of the discal spots.

I know of no specimens of *pekahia* from other than Venezuelan localities, and thus this form seems to be confined to a geographical range within that of typical *amphion*. In the absence of data I am unable to determine the exact relationship of *pekahia* to *amphion*, but Brigadier Evans considers it to be a form thereof.

The genitalia of our only male specimen are too malformed to be of any use.

Telemiades antiope Plötz

Figure 4

Proteides antiope Plötz, 1882, p. 71. Colombia and Para.
Telemiades antiope, Godman, 1907, p. 135.
Telemiades antiopa, Mabille and Boullet, 1912, p. 121.

Godman says that the Plötz unpublished figure of *antiope* represents a variety of *Telemiades amphion* Geyer. Mabille and Boullet place *antiope* (spelled *antiopa*) as a synonym of *amphion* and in this action have been followed by subsequent authors.

The brief description of *antiope* seems sufficient to distinguish it from *amphion*, as Plötz says that the white hyaline spots of the discal band of each primary wing do not reach the costal margin of the wing. This indicates that there is no spot of the discal band lying on the costal margin above the cell spot. I have seen no specimen of *amphion* having a well-defined discal band in which the spot on the costal margin is absent.

Before me are three specimens which agree with the description of *antiope:* a male from Zanderij Island, Boven, Para District, Dutch Guiana, and two females, one from St. Laurent, French Guiana, and the other from Dabadie, Trinidad, British West Indies. These specimens resemble the male form of *amphion* in which the cell spot of the hyaline discal band of each primary wing is deeply excavated, but they are easily distinguished from that form of *amphion* by the absence of the hyaline spot on the costal margin above the cell spot and by the three well developed, subapical, hyaline spots, of which the lowest one is the same size, or a little larger, than the one above it. On the under side of each secondary wing there is a small dark spot at the anal angle.

The female of *antiope* is similar to the male; the hyaline spots of the discal band of each primary wing are only a little larger than those of the male and are not so greatly enlarged as they are in the female *amphion.*

The uncus of the male genitalia of *antiope* is somewhat longer and stouter, and the rod-like structure along each side of the tegumen is broader, than in *amphion.* The series of internal spines of the aedeagus is well developed. Each clasper terminates in a short triangular apex which is heavily covered with short teeth, and immediately behind it is another small angulation that is also toothed on its dorsal edge.

Telemiades fides, new species

Figure 7

MALE: The upper side of the wings is brown, lightly overscaled with yellowish gray. On each primary wing are seven white hyaline spots, of which three are subapical and four form a discal band. The subapical spots are small but well developed, and the lower one is a little outward of the spot above it. The discal band is composed of a minute spot in about the middle of the costal margin; a large spot crossing the cell and excavated on its outer side, the lower arm of the excavation is broad, bluntly rounded at the apex, and longer than the upper arm; a quadrate spot in interspace 2, the outer side of which is a little excavated; a small triangular spot in interspace 3, a little excavated on the outer side, the rounded apex of this spot about reaches as far as the apex of the lower arm of the cell spot and almost to the center of the upper side of the spot in interspace 2. There is a dark outer marginal band. The apex of the cell is narrowly darker. There is a dark spot below the lower subapical spot and two dark spots in interspace 1, one near the base and the other towards the outer margin. There is a slight angulation in the outer margin at the end of vein 1. The fringes are brown, slightly paler outwardly.

On each secondary wing the anal angle is produced into a slight lobe. There are a sinuous dark discal band, which is rather inconspicuous, and a dark subbasal spot. There are long brown and yellowish brown hair scales along the inner edge of the abdominal fold. The fringes are as on the primary wing.

The under side of the wings is paler brown than on the upper side. Both primary and secondary wings are overscaled with yellowish, the secondary wings quite heavily so. The hyaline spots of the primary wings and the dark bands of both primary and secondary wings are repeated, the latter more distinct than on the upper side.

On the upper side, the head, thorax, and abdomen are yellowish brown. On the under side, the palpi and pectus are yellow brown; the thorax and abdomen, yellow and brown intermixed. The antennae are black on both sides, spotted with yellowish at the joints on the under side. The clubs are reddish on the under side.

FEMALE: The female is similar to the male except that the hyaline spots of the discal band of each primary wing are enlarged.

Length of one primary wing: male, 17–18 mm.; female, 18 mm.

TYPE MATERIAL: The holotype male and the allotype female are from Balboa, Canal Zone, Panama. Paratypes: One male from the same locality as the holotype; one male from Tapia Bridge, Panama; one female from Lascascadas, Panama; one male from Presidio, Vera Cruz, Mexico.

This species quite closely resembles *amphion*, but the lowest hyaline subapical spot of each primary wing is well developed and not very small as it is in *amphion*.

The uncus and the aedeagus of the male genitalia of *fides* are similar to those of *amphion*, but the termination of the clasper is different. Each clasper of *fides* terminates in a short, triangular apex on which are numerous short teeth.

Telemiades brazus, new species

Figure 5

MALE: The upper side of both primary and secondary wings is a somewhat rufous brown. Each primary wing has three white hyaline subapical spots in an oblique line, the lowest spot a little outward of the one above it. There are two dark bands. The outer one begins on the costal margin, encloses the three hyaline subapical spots, runs downward across interspaces 5 and 4, then curves inward to a little beyond the end of the cell and downward to vein 1. This outer band begins narrowly on the costal margin and widens as it extends downward. The inner band crosses the cell a little before its apex and extends to vein 1. The two bands are connected along the costal margin of the wing. There is a narrow dark line bordering the apex of the cell. All the veins of the wing are slightly darker than the ground color. The fringes are concolorous.

On each secondary wing the basal area is dark, and there is a dark discal band in which there is a deep excavation just below vein 6. The fringes are concolorous.

On the under side the ground color of both primary and secondary wings is paler rufous brown than on the upper side. The apical area of the primary wing is darkened. The two dark bands and the dark line bordering the apex of the cell are repeated, but the two bands are much narrower and less prominent and tend to become broken into separate spots. In and along the abdominal fold on the secondary wing there is an overscaling of grayish which, in scattered scales, extends to the middle of the discal area. The dark discal band and the dark basal area of the upper side are repeated, but the discal band is narrow, indistinct, and broken into separate spots, and the dark basal area is represented by three separated spots which tend to become indistinct.

The top of the head and body is brown with some fulvous brown scales intermixed. On the under side the palpi, pectus, thorax, and abdomen are grayish. The antennae are black on the upper side, and on the under side they are blackish brown in the basal half; the rest, including the clubs, is pale fulvous brown.

Length of one primary wing: 20–22 mm.

TYPE MATERIAL: From the State of Santa Catharina, Brazil.

The holotype male is from Neudorf, November 9, 1939. One male paratype from Massaranduba-Blumenau.

This species is not a member of the *amphion* group but superficially resembles *Telemiades delalande* Latreille (1822, p. 761, no. 95, note). On the upper side of the wings the white hyaline subapical spots of each primary and the dark discal bands of each primary and secondary are extremely similar, but there is a more or less defined purple sheen on the wings of *delalande* which is not present on the wings of *brazus*. On the under side of the wings, the dark bands of each primary and secondary of *delalande* are generally well formed, continuous, and more or less prominent, whereas those of *brazus* tend to become broken into separate spots, especially on the secondary wings, and are not prominent.

The male genitalia of *brazus* have a rod-like structure on each side of the tegumen, and each of these has a short projection from its ventral edge a little before the base of the uncus. Each clasper terminates in a long triangular apical arm on which there are a number of teeth. The aedeagus is long and stout and has a series of internal spines.

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SOME AFRICAN AND BRAZILIAN STRATIOMYIDAE (DIPTERA)

By Maurice T. James

The present paper is based on a collection of Stratiomyidae made at Natal, Brazil, and in Liberia, mostly near Robertsport, by Dr. Fred M. Snyder, during 1943, and given in part to the author and in part to the American Museum of Natural History. All holotypes and allotypes are the property of the American Museum of Natural History.

BRAZILIAN SPECIES

Hoplistes pleuralis, new species

Male: Head shining yellow, variegated with black as follows: the ocellar triangle and adjacent ocular orbits; a transverse band just above the frontal callus; a cross band just above and adjacent to the antennal bases, narrowly touching the eyes and sometimes contiguous with the frontal band; the face, except the narrower lower and the broader upper orbits; and the occiput, except the broad orbits and the upper two-thirds of the median plate. Facial orbits silvery tomentose; face and lower part of occiput, including lower orbits, silvery pilose. Pile of frons very short, black, inconspicuous, that of vertex and of upper part of occiput, excluding orbits, also short and black, but somewhat more clearly evident. Ratio of antennal segments 8:5:4:2:3:1:3:30; scape and pedicel yellow, with black hair; flagellum with first segment bright yellow, a little narrower than apex of pedicel, the next two segments becoming gradually narrower and brownish, suddenly contracted into the black, three-segmented terminal arista, which is rather broad basally. Proboscis black, the labella brownish.

Thorax black, variegated with greenish yellow as follows: humeri; a pair of dorsal bands, extending backward from each humerus to a point opposite the wing bases, sometimes outwardly angulate at the suture; supra-alar regions; scutellum except spines; the narrow upper complete margin and the broad posterior margin of each mesopleuron; and three large spots, one on the upper part of the sternopleuron, one on the lower part of the pteropleuron, and one taking in most of the metapleuron. Pile of pleura silvery, that of dorsum inconspicuous, mostly concolorous with the background, but black and whitish intermixed on the scutellum. Scutellar spines brownish at base, blackish towards the apex.

Front coxae mostly black, middle and hind pairs mostly yellowish to brownish; femora yellow; tibiae black, the front and hind pairs each tending towards brownish apically and each with an indistinct brownish median annulus which is beyond the middle on the fore and before the middle on the hind pair; basitarsi and base of second segment of each tarsus white, tarsi otherwise blackish. Wings subhyaline with brownish stigma; cell R_3 about three times length of R_4. Halteres yellow with greenish knobs.

Abdomen black, variegated with greenish yellow as follows: a broad band, taking in all but the basal angles, and the narrow lateral margin of the first tergum; the apical margins of terga two and three, narrow and sometimes not reaching the margins on two, somewhat broader on three; broad lateral margins of terga four and five; a prominent transverse area, sinuate anteriorly and broadly separated laterally from the margins, on apical third of tergum four, and a similar, though inconspicuous and greatly reduced apical area on tergum five; pile largely concolorous with background; genitalia yellow.

Length 6–7 mm.

FEMALE: As described for the male, except in the abdominal pattern; first segment as in the male; second wholly black; third with a suboval marking on each posterior corner of the tergum, reaching its median third along the incisure, but usually leaving the lateral margin largely black; fourth and fifth terga as in the male, except that the fourth lacks the transverse marking.

TYPES: Holotype, male, allotype, female, and paratypes, seven males and three females, Natal, Brazil, February 5 to 24, 1943 (F. M. Snyder).

This species may readily be distinguished from *H. bispinosus* (Wiedemann), the only other known member of the genus, by the much longer cell R_3 and the correspondingly short cell R_4, the more extensively black pleura, and the complete black transverse band above the frontal callus.

The following specimens were also collected by Dr. Snyder at Natal, Brazil, February 5 to 24, 1943:

Microchrysa bicolor (Wiedemann), two females
Ptecticus testaceus (Fabricius), one female
Sargus thoracicus Macquart, one female
Hermetia illucens (Linnaeus), one male
Cyphomyia lanuginosa Gerstaecker, two males, two females

AFRICAN SPECIES

Diplephippium snyderi, new species

MALE: Head brownish to brownish black; narrow facial orbits with silvery tomentum which extends onto the front, where the areas are narrowly separated medially, thence along the line separating the practically contiguous eyes to the median ocellus. Occiput with narrow orbits silvery tomentose on lower part; some silvery pile on lower half of occiput. Eyes bare. Antennae reddish brown on scape, pedicel, and basal three segments of flagellum, thence gradually becoming black. Proboscis yellow; palpi brownish, the apical segment black.

Prothorax brownish, the pronotum punctured; mesonotum and dorsal aspect of scutellum black, evenly punctured; pile mostly blackish, inconspicuous; a broad area of silvery tomentum before the scutellum, extending about two-fifths of the way to the suture, and a small silvery patch before each lateral spine, continuous with the mesopleural silvery tomentum; lateral spines of mesonotum strong, brownish, black at base; upper scutellar spines black at base, becoming yellow apically; apex, lower side, and lower spines of scutellum yellow; upper and lower spines diverging from each other at a little less than a right angle. Pleura for the most part black and punctured, tending to become brownish on the bare, unpunctured areas; pile largely black on anterior half of mesopleura, otherwise silvery.

Femora pale yellow on basal three-fifths; apical two-fifths of femora and the tibiae yellowish brown on front and middle pairs and brownish black on hind pair; tarsi yellow, becoming darker towards apex, especially on hind pair. Halteres yellow, the knobs somewhat brownish above. Wings hyaline, with two infumated areas: the first an elongated spot taking in the subcostal, the first basal, and the anterior part of the second basal cells, and the stigmatal area, where it is widest and most intense in its darkening; the second a rounded spot extending through the second submarginal into the third posterior cell, but at most less than halfway across it; the apex of the wing and the costal, first submarginal, and discal cells are entirely hyaline; the infuscation as a whole is similar to that of *D. tessmanni,* though less extensive on the apical spot.

Abdomen densely punctured dorsally, a little less regularly so ventrally; black, tending to become brownish very narrowly along the incisures, especially ventrally, and along the lateral margin; pile short, inconspicuous, black, with prominent areas of silvery tomentum as follows: a median area extending from the middle of the fourth segment to the apex of the fifth; a lateral triangle on each side of the fourth and another on each side of the fifth segment, and extending the length of the respective segment, their bases lying on the bases of the segments; and a ventral area including the first, the median half of the second and third, and the median basal area of the fourth sterna. Another large dorsal spot of silvery tomentum occurs on the second and third segments and extends almost the width of the abdomen, though interrupted medially; this area, however, is invisible, except as viewed from behind and with the proper light incidence. Genitalia yellow.

Length 6.5 mm.

TYPES: Holotype, male, Robertsport, Liberia, December 4, 1943 (F. M. Snyder); paratypes, male, Robertsport, January 19, 1944 (Snyder), and male, Bendu, Robertsport, Liberia, February 26, 1943 (Snyder).

The following key will serve to separate the known species of *Diplephippium.*

1. Mesonotum uniformly punctured; veins M_1 and M_2 separated at their bases by a crossvein..2
   Mesonotum with anterior margin and median line devoid of punctures; veins M_1 and M_2 arising together at apex of discal cell.................
   ....*amphicentrium* Speiser
2. Infuscated area reaching wing apex, though with reduced intensity; male with mesonotum at least medially, and abdomen beyond second segment brownish; dense tomentose areas of thorax and abdomen golden
   ....*tessmanni* Grünberg

Wing clearly hyaline at apex; mesonotum and abdomen, except laterally and at incisures, black; dense tomentose areas of thorax and abdomen silvery.................................*snyderi*, new species

Dolichodema fenestrata, new species

FEMALE: Head entirely subshining black, except a small elongated rectangular ivory spot adjacent to each eye on the lower part of the front; head clothed with a rather inconspicuous but fairly evenly distributed silvery tomentum; facial orbits and lower occipital orbits very narrowly bordered with silvery pruinescence, this area being conspicuous only below each eye. Antennae structurally as in *africana;* scape and pedicel shining, reddish; first six segments of flagellum pruinescent, the ground color grading from reddish on the first and second flagellar segments to black on the fifth and sixth; seventh and eighth black, with dense black hair. Proboscis and palpi brown.

Thorax mainly dull black; humerus brownish; mesopleuron with upper margin, expanding into a large triangle on its posterior part which extends almost to the sternopleuron, polished, ivory; postalar calli and pteropleura tending to reddish. Thorax almost entirely clothed with an inconspicuous whitish to silvery tomentum. Front legs reddish, the basitarsi somewhat more yellowish, especially dorsally; middle legs mainly reddish, the coxae darker, the femora blackish on basal third to half, the basitarsi whitish, especially dorsally; hind coxae, femora, and tibiae except bases, black, trochanters and bases of tibiae dark reddish, tarsi reddish yellow, except that basitarsi are whitish dorsally; tarsal hairs tending towards black dorsally, yellow ventrally; legs otherwise with tomentum as on the thorax. Wings subhyaline; apex beyond stigma and discal cell infumated, the stigma dark brown; veins brownish, all distinct to their apices. Halteres with reddish yellow stalks and white knobs.

Abdomen dull black, except for a large spot that takes in most of the second and an adjacent triangle on the third segment, both dorsally and ventrally; this spot is so transparent that the femora can clearly be seen through it. Tomentum mostly as on the thorax; it is sparse, however, on the transparent areas, and forms two dense patches on the last tergum; some erect whitish pile on the sides of the first and second terga and on the first sternum.

Length 9 mm.

TYPE: Holotype, female, Bendu, Robertsport, Liberia, March 27 (F. M. Snyder).

This species can be readily distinguished from *D. africana* Kertesz, the only other known species of this genus, by the bicolored middle and hind femora, the extensively black pleura, and the transparent abdominal spot. *D. brevicephala* Brunetti is, as I have shown elsewhere, a synonym of *Hermetiomima melaleuca* Grünberg.

Enypnium quadripunctatum Kertesz

Enypnium quadripunctatum KERTESZ, 1914, Ann. Hist. Nat. Mus. Natl. Hungarici, vol. 12, pp. 536–537, fig. 67.

Bendu, Robertsport, Liberia, March 7 and April 1, 1943 (F. M. Snyder), four males; Bwamba, Uganda, July–August, 1946 (Van Someren), one female.

The female of this species has not previously been recorded in the literature. It differs from the male in that the front is about twice as wide, the front and face being of approximately equal width, with parallel sides; and in that the abdomen is not silvery pruinose.

Ashantina antennata Kertesz

Ashantina antennata KERTESZ, 1914, Ann. Hist. Nat. Mus. Natl. Hungarici, vol. 12, pp. 539–540, figs. 68, 69.

Bendu, Robertsport, Liberia, February 26, March 15 and 20, and April 1, 1943 (F. M. Snyder), five males, two females; Robertsport, Liberia, December 9, 1943 (Snyder), one male.

Grünberg (1915, Mitt. Zool. Mus. Berlin, vol. 8, p. 53) has described the variation in coloration existing in this species. In my series of specimens, the abdomen is predominantly reddish yellow in the males, blackish in the females.

The following specimens were also collected at Robertsport, Liberia, by Dr. Snyder:

Platyna hastata (Fabricius). Benduja, 1000 feet, December 1, 1943; Benduja, December 1 to 2, 1943; Bendu, March 18, 1943; 17 males and females

Platynomorpha doryphora Grünberg. Bendu, April 1, 1943, one male

Tinda nigra (Macquart). Bendu, February 26 to March 5, March 18, March 27, April 1, and April 27, 1943; November 1 and 2, December 6, 7, and 10, 1943; 22 males and females

Isomerocera quadrilineata (Fabricius). December 6 and 7, 1943; Bendu, March 13, 17, 18, and 27, and April 27, 1943; 11 males and females

Argyrobrithes argenteus Grünberg. November 15, October 26, and December 7 and 23, 1943; Bendu, February 26 to March 5, March 15, 17, and 27, 1943; 16 males and females

Gobertina picticornis Bigot. December 1, 1943; Bendu, February 26 to March 5, March 27, 1943; six males and females

Negritomyia loewi Brauer. November 24, 1942, and November 2, 1943; Bendu, February 26 to March 5, March 17 and 27, 1943; seven males and females

Ptecticus elongatus (Fabricius). October 26, 1943; Benduja, December 1 to 2, 1943; Bendu, February 26 to March 5, March 7, 13, and 15, and April 1, 11, and 27; 24 males and females

Ptecticus cinctifrons Grünberg. December 14, 1943; Bendu, February 26 to March 5, March 7, 15, and 27, 1943; 13 males and females

Sagaricera aenescens Grünberg. Bendu, March 13, 18, and 20; three females

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A NEW FROG OF THE GENUS *PLATYMANTIS* FROM THE SOLOMON ISLANDS

BY WALTER C. BROWN[1]

Three specimens in the American Museum of Natural History, secured on Bougainville Island by the Whitney South Sea Expedition, represent an apparently unknown frog of the genus *Platymantis*. It is quite distinct from *P. solomonis*[2] (Boulenger) and *P. weberi* Schmidt, the species heretofore known from the Solomon Islands. I am indebted to Mr. Charles M. Bogert for permission to describe it at this time, and pleased to have the opportunity to associate the name of Dr. George S. Myers with this new ranid.

Platymantis myersi, new species

TYPE: Adult female, from Bougainville Island, A.M.N.H. No. A-35348.

PARATYPES: Two specimens, A.M.N.H. Nos. 34324 (now Stanford No. 9335) and 35340 from Bougainville Island.

DEFINITION AND DIAGNOSIS: A *Platymantis* with pointed, protruding snout, tympanum small, broadly elliptical, covered with a thin, closely adhering skin, diameter less than one-half that of the eye. Finger tips strongly dilated, depressed, with distinct disks; first and second fingers of equal length, third longer than the snout. Venter quite dark, heavily mottled with brown; skin comparatively smooth. Apparently this species is most closely related to *vitianus* (A. Duméril) or *unilineatus* Peters (if the latter may be regarded as distinct) from the Fiji Islands, from which it differs in that the interorbital space is much narrower than the breadth of the upper eyelid (not equal to it); the diameter of the tympanum is less than (not equal to) one-half that of the eye; and the outer metatarsal tubercle is distinct.

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[1] Natural History Museum, Stanford University, California.

[2] Burt and Burt (1932, Bull. Amer. Mus. Nat. Hist., vol. 63, p. 491) include the specimens herein described in their list of specimens referred to *Rana solomonis* (Boulenger).

Description of the Type: Head moderately broad, its width greater than its length; snout pointed, projecting beyond the lower jaw, its length one and three-eighths times the diameter of the eye, measured along the side of the head; nostril somewhat nearer to tip of snout than to eye; interorbital distance much less than the width of the upper eyelid, almost equal to the distance between the external nares; tympanum broadly oval, its dorsoventral diameter slightly greater than its anteroposterior diameter, but less than one-half the diameter of the orbit; canthus rostralis distinct, moderately sharp; loreal region slightly oblique, weakly concave; tongue with a narrow, deep, median notch posteriorly; vomerine teeth in two slightly oblique patches with the anterior angle of their bases between the choanae, but the toothed crests well behind the level of the posterior borders of the choanae.

Fore limb well developed; when adpressed along the body, the third finger reaches posterior to the anus; fingers long, the third longer than the snout, the first and second equal in length, both shorter than the fourth; the finger tips dilated, about one and one-half times as broad as the adjacent phalanx, dorsoventrally depressed, the ventral surface of the dilation forming a flattened disk, separated terminally and laterally from the dorsal surface by a prominent groove; fingers not webbed at base but with a narrow dermal flange along the lateral surfaces from the base to the disk; subarticular tubercles large, round to slightly oval, somewhat flattened, though slightly more projecting distally; outer metacarpal tubercle strongly projecting, elliptical, its length twice its breadth; middle one large, roundish, flattened; outer smaller, narrowly elliptical.

Tibiotarsal articulation reaches anterior to the eye; length of tibia almost one and one-half times the breadth of the head; heels moderately overlapping when the hind limbs are folded at right angles to the body; toes in order of length 1, 2, 5, 3, 4, with minute webs at base, webs reaching the basal tubercle on the inside of the fourth toe and its distal end on the outside of the third; tips of toes dilated and depressed with flat ventral disks separated by a very prominent groove from the dorsal surface, as are those of the finger; disks about equal in size to those of the fingers; subarticular tubercles prominent, moderate in size, oval, more strongly projecting distally than those of fingers; inner metatarsal tubercle prominent, elongate elliptical, its length equal to its distance from the distal end of the tubercle of the first finger; outer metatarsal tubercle distinct, small, and round.

Skin of the dorsum rather smooth except for scattered small tubercles, more pronounced on the extreme posterior part of the body; lateral surfaces and dorsolateral margins more strongly granulate and rugose with narrow glandular folds and tubercles; posterior aspect of the thighs strongly granulate; posterior venter only moderately so; under surface of head, throat, and pectoral region smooth.

COLOR: Dorsum (in preservative) dark grayish brown with a darker brown blotch between the eyes posteriorly, and poorly defined, very broad, dark transverse bands in the shoulder region and the middle of the back, darker posteriorly; limbs with rather broad, somewhat indistinct dark bars; posterior thighs dark reddish brown; upper lateral surfaces dark brown; lips with very broad, irregular blackish bars; sides of the head dark; tympanum with a light crescent ventrally; venter dark, heavily mottled with dark brown throughout; lower surface of hands and feet dark brown to blackish.

MEASUREMENTS (IN MM.): Snout to vent 58, head width 22.5, head length 19.25, snout 11, eye to nostril 6.5, eye 8, tympanum 3.5, interorbital space 4, lower fore limb 12.75, third finger 13, tibia 31, foot (from base of inner metatarsal tubercle) 31.75.

VARIATION: The three adult specimens (the type and paratypes) are quite uniform in the long, pointed snout; the small, oval tympanum, diameter less than one-half that of the eye; the long fingers with dilated and depressed tips and with flattened ventral pads; the dorsal surface of the body almost free from any elongate folds; and the dark ventral color pattern.

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MISCELLANEOUS SYNONYMY AND NEW SPECIES AMONG THE LAMIINAE (CERAMBYCIDAE)

BY LAWRENCE S. DILLON AND ELIZABETH S. DILLON

Owing to the lack of interchange of publications and communications among the enemy nations during the past war, it was inevitable that some duplication of effort and synonymy should occur that normally would have been avoidable. In the following paper, some instances of this sort that have come to the authors' attention are pointed out. The appended descriptions of new species are mostly of specimens that were received too late to be included in the monographs of their respective tribes; the types of these have been deposited in the collections of the American Museum of Natural History, unless otherwise indicated. Thanks for the loan of this material are extended to Dr. Mont A. Cazier. For other specimens the authors are indebted to Mr. Lionel Lacey, of New Rochelle, New York, and to Dr. P. J. Darlington, of the Museum of Comparative Zoölogy, Cambridge, Massachusetts.

In his studies on the Lamiinae, Stephen Breuning (1943–1945) of Vienna included a monograph of the Monochamini, unaware of the treatment given its Western Hemisphere components by the present writers in 1941. Some comments and corrections are therefore necessitated:

Taeniotes insularis Thomson. As Breuning placed *Ptychodes insularis* Fairmaire in the genus *Taeniotes*, *T. insularis* Thomson became a secondary homonym, which hence was renamed *thomsoni* by Breuning. However, as Fairmaire's species is correctly placed in a separate genus, *Neoptychodes*, Breuning's name is unnecessary and falls as a synonyn of *T. insularis* Thomson.

Ptychodes lecontei batesi Breuning appears to be an intergrade between *lecontei* and *politus*, many variants occurring in the type locality (Nicaragua) of this new name, which accordingly should be placed as a synonym of *lecontei*.

Ptychodes taeniotoides Thomson (1865) is placed as a subspecies of *niveisparsus* Bates (1872) by Breuning. The two are actually distinct species.

Parataeniotes Breuning (January, 1943; genotype: *Ptychodes dejeani* Thomson) unfortunately must be placed as a synonym of *Chyptodes* Dillon and Dillon (1941) with identical genotype. *Parataeniotes* Dillon and Dillon (1943) (genotype: *P. mimus* Dillon and Dillon), being a homonym, must be altered; the authors propose that it be called *Pseudotaeniotes*, new name.

Deliathis poecilodryas Bates. From Breuning's figures of this species and of *Hammoderus impluviatus* Lacordaire, it is obvious that the two are identical. Bates' name hence must fall as a synonym; the species, however, belongs in *Deliathis*.

Hammoderus strandi Breuning. This species appears from the description to be identical to *Plagiohammus olivescens* Dillon and Dillon, but it is impossible to ascertain this at present. The latter name would fall as a synonym.

In an earlier paper, Breuning (1942) described the genus *Pachypezomorpha* (p. 164), with *P. strandi* Breuning as its genotype, stating that it was related to *Pachypeza*. From the description it is evident that this is a synonym of *Helvina* Thomson, which at that time was incorrectly listed among the Onciderini and which Breuning consequently overlooked (see Dillon and Dillon, 1945). For his species *strandi* he gives only characters of surface sculpturing in his brief description, failing to mention coloration or maculation of any sort. As the characters given can apply to any of the three known species, it is impossible to identify it. Therefore, as no "summary of characters—differentiating it from other species" (Article 25, section cl, of the International Rules of Zoological Nomenclature) is given, it should be treated as a *nomen nudum*.

Monochamus maculosus Haldeman. As Breuning has pointed out, this name is preoccupied by *M. sutor maculosus* Voet (1778) and hence the species should be called by the next available name, *M. clamator* LeConte.

Plagiohammus camillus, new species

Close to *P. sallei* Thomson and *P. confusor* Dillon and Dillon. From the former it is distinct in having the elytral maculae contrasting in color with the general pubescence. From the latter it is distinct in having the elytral maculae orange ochraceous, more sharply defined and more numerous, the elytra have a shorter spine at apex, and the pronotal disk is less roughly sculptured, with a small tubercle medially before basal sulcus.

MALE: Elongate-ovate, rather robust, subcylindrical, elytra subconvex; head and pronotum dark reddish brown, elytra slightly paler; entirely tawny pubescent, with orange ochraceous markings as follows: head on vertex and margins of lower lobe of eye. Pronotum with two rather indistinct fasciae, one behind apical sulcus and one preceding basal sulcus. Elytra with many irregular, moderate-sized maculae on disk, sometimes somewhat coalesced; at extreme base each elytron with a large macula. Beneath and legs dark reddish brown, densely clothed with tawny pubescence, mesosternal side-pieces tinged with orange ochraceous. Antennae with scape and third segment dark reddish brown, remaining segments paler; scape heavily, remaining segments thinly, clothed with tawny pubescence.

Head above finely, densely punctate, with a median impressed line from occiput, extending between antennal tubercles to epistoma on front; front finely, densely punctate, with a few coarse punctures laterally; antennal tubercles approximate basally, divergent apically. Pronotum slightly transverse; sides feebly arcuate; disk, laterally behind apical sulcus, with two short carinae, and at middle, just before basal sulcus, a small but distinct tubercle; surface with a few scattered punctate granules; lateral tubercles broad, well elevated, with a robust, blunt spine at tip. Scutellum feebly transverse, sides nearly straight, oblique, apex narrowly arcuate. Elytra broadly arcuate, apices narrowly rounded and with a moderate spine at tip; extreme base smooth, thence to basal quarter finely, moderately densely granulate, thence to apex with coarse, glabrous punctures which are well separated. Mesosternum with a well-elevated, rounded tubercle; fifth sternite broadly emarginate at apex. Antennae with middle of sixth segment reaching to tip of elytra (remainder missing).

Length 30 mm., width 9.5 mm.

Holotype: Male; Peru; F. Woytkowski, collector; in authors' collection.

Truncatoides caviunas, new species

Superficially resembles *Lesbates acromii* Dalman, but with a large, dark brown, irregularly shaped macula, the posterior margin deeply bidentate behind the crested humerus; the antennae more slender and capitate instead of being robust and strongly clavate; the abdomen medially is broadly dark brown, glabrously vittate.

Female: Elongate-ovate, robust, convex; dark reddish brown or piceous, entirely covered with mottled white and dark grayish brown pubescence. Head with front having the white pubescence predominating; vertex with a tinge of ochraceous and a very narrow margin of same color; front of lower lobe of eye ochraceous. Scutellum dark brown pubescent. Elytra with a large, dark brown macula behind crested humeri, which has the posterior margin strongly bidentate. Beneath dark reddish brown, abdomen piceous, the sterna with same pubescence as above but the brown predominating laterally. Abdomen glabrous, shining, with a broad ochraceous or bright fulvous vitta laterally, somewhat less broad on first sternite. Legs dark reddish brown or piceous, white and dark brown variegate, with some ochraceous pubescence interspersed; femora all annulate near middle with dark brown, protibiae and mesotibiae annulate basally and apically and metatibiae only basally, with dark brown. Antennae with scape and third segment piceous or dark reddish brown, covered with same pubescence as upper surface of body and also tinged with ochraceous, the capitate portion of scape with an irregular, dark brown macula; from fourth segment the antennae dark brown on apical third and testaceous on basal two-thirds, rather thinly, finely grayish pubescent.

Head with front finely, densely punctate, with a few coarse punctures interspersed; genae sculptured as in front; eye with lower lobe oblong-ovate rather than ovate. Pronotum transverse, sides straight, unarmed, narrowed to apex; disk with an elongate median tubercle and either side of middle a large rounded tumescence; basal sulcus wide, shallow. Scutellum transverse, sides straight, apex subtruncate, depressed medially. Elytra with sides broadly arcuate, tapering to apices, each of which is broadly, separately rounded; disk basally with a strong, prominent humeral crest, extending nearly halfway to suture, carinate on apex; gibbosity distinct, oblique, arcuate; basal half of disk with well-spaced, coarse punctures, these becoming somewhat finer towards apex. Fifth sternite at apex subtruncate, triangularly impressed medially. Antennae slightly shorter than body, from fourth segment gradually shorter.

Length 15 mm., width 7.6 mm.

HOLOTYPE: Female; Caviuna, Paraná, Brazil; October, 1945; A. Maller, collector.

Oncideres nicea, new species

Closely allied to *O. ilaire* Dillon and Dillon but differs in the following ways: integumental color black instead of reddish brown; the larger white maculae of elytra less numerous and scattered, the minute ones more numerous and extending onto base; glabrous tubercles of base more strongly elevated, and a slight gibbosity on each elytron basally; beneath clothed with white pubescence.

FEMALE: Elongate-ovate, moderately robust, subcylindrical, elytra convex; black or brownish black, entirely grayish brown pubescent, except on head and pronotum the pubescence tends to ochraceous. Head with lower lobe of eye margined with ochraceous, wider on anterior margin. Pronotum with several transverse, glabrous carinules, not entire. Elytra from basal fifth minutely irrorate with white maculae of two sizes, the larger, few in number, very scattered extending from basal quarter to apex, the smaller very numerous and extending from basal fifth to apex. Beneath dark reddish brown to piceous, white pubescent, mesosternal side-pieces and metepisterna tinged with ochraceous. Legs piceous, clothed with ochraceous and white variegated pubescence, the ochraceous predominating. Antennae with scape and third segment piceous, remaining segments gradually paler, with the extreme apices darker; entirely clothed with thin, whitish pubescence, the scape faintly tinged with ochraceous.

Head above minutely alutaceous; front rather broadly concave between antennal tubercles, surface minutely, densely punctate; genae vertical, scabrose; eye with lower lobe oblong-ovate, slightly longer than gena; antennal tubercles prominent, unarmed at apex. Pronotum transverse, wider apically; apical sulcus wide, shallow, basal one deep, narrow; disk transversely multicarinulate, carinules sometimes interrupted; lateral tubercles small but distinct, with a short, obtuse tooth at apex. Scutellum transverse, sides and apex arcuate. Elytra with sides broadly arcuate, feebly widened behind middle; apices together rounded; extreme base smooth, on basal quarter with a distinct gibbosity on each one, the gibbosity with from six to eight large, strongly elevated granules, surrounded with a number of smaller granules which extend to humeri; disk with coarse, very shallow punctures which become smaller and obsolete apically; humeri arcuate, with a large, rounded tubercle at angle. Procoxae tumid, unarmed; profemora robust, rather broadly clavate, not rugose, remaining femora less robust, clavate. Fifth sternite about one-third longer than fourth, at apex shallowly triangularly impressed; apex broadly emarginate. Antennae slightly less long than body; scape robust, clavate, grooves at base nearly obsolete, surface minutely, obsoletely punctate; third segment robust, nearly twice length of scape, feebly sinuate; fourth much shorter, slightly more robust than following segments which are gradually shorter.

Length 18 mm., width 7 mm.

HOLOTYPE: Female; Satipo, Peru; September, 1944; A. Maller, collector.

Oncideres trigerta, new species

While resembling *O. satyra* Bates most closely in elytral maculation and in coloration of the under surface, this species is probably closest to *O. saga amazona*, preëminently in the maculation of the pronotal disk. From the latter it is distinct in having more tubercles on the base of the elytra; the elytra light brown pubescent, not fulvous, with the white maculation somewhat reduced in quantity and never forming rosettes, and the under surface lacking white pubescence on the abdomen.

MALE: Elongate-ovate, robust, subcylindrical; black, elytra fuscous, entire upper surface fulvous brown pubescent, somewhat paler on pronotum, and a little redder on most of head. Pronotum with a transverse, median, glabrous carina, indistinctly expanded into five minute, glabrous maculae, which are elevated. Elytra behind basal sixth rather densely covered with small and minute white maculae, irregularly placed, often forming short longitudinal rows, never condensed into rosettes, on anterior two-thirds rather more sparse. Beneath fuscous, yellowish gray pubescent; sterna each side with a rather broad, sublinear, white macula, not sharply delimited; abdomen with trace of an obsolete white vitta at extreme sides. Legs piceous, with fulvous, brown, and ashy pubescence. Antennae black, segments from fifth gradually becoming dark reddish brown; fulvous brown pubescent.

Head minutely alutaceous; front broadly concave between antennal tubercles, rather finely, moderately sparsely punctate; genae glabrous, coarsely rugose; eye with lower lobe elongate-oblong, nearly twice height of genae; antennal tubercles very prominent, at apex with an obsolete tooth. Pronotum transverse, behind lateral tubercle feebly constricted; disk at middle transversely carinate, the carina broad, not sharply defined, more strongly elevated here and there; lateral tubercles broad, not prominent, ending in a short, obtuse spine. Elytra attenuate, apically less strongly so, apices together rounded; base with a few large, shining granules, placed five or six on each gibbosity and surrounding area, and a larger number of somewhat finer ones behind humerus; basal half with rather dense but shallow punctures, becoming finer to middle, behind which point they disappear; humeri feebly rounded, entire angle glabrous, the terminal tubercle slightly larger than the other. Procoxae with a prominent, large, rugose tubercle; profemora very robust, widest basally, sides nearly straight, coarsely rugose; fifth sternite slightly longer than fourth, broadly retuse at apex. Antennae about two-fifths longer than body, the eighth segment attaining elytral apex; sparsely fringed beneath; scape gradually clavate, deeply grooved beneath.

Length 23 mm., width 8.3 mm.

HOLOTYPE: Male; Satipo, Jauja Province, Peru; March, 1945; P. Paprzycki, collector.

Oncideres poeta, new species

Related to *Oncideres ophthalmalis* but differs in having the under side of the humeri dark brown pubescent; in lacking the light fascia of the elytra; and in that the mesepisterna are chalky white pubescent.

FEMALE: Elongate-ovate, rather slender, cylindrical, elytra convex; piceous, elytra dark reddish brown. Head red ochraceous pubescent, with scattered hairs of silvery gray interspersed; eyes feebly outlined with the first pubescence. Pronotum with same pubescence as head but the gray is more abundant. Scutellum thinly red ochraceous pubescent. Elytra on basal third red ochraceous pubescent, with minute, scattered patches of silvery gray; thence to apex the red ochraceous pubescence forms indistinct, rounded maculae surrounded by the silvery gray pubescence; entire elytra with well-spaced glabrous maculae, those on basal third are larger and granular, thence to apex smaller and punctate; the under side of humeri to near middle dark brown pubescent. Beneath dark reddish brown, thinly red ochraceous pubescent, prosternum, mesosternum, and metasternum pale gray medially, the sternites with pale gray intermixed with the other pubescence, in nearly equal amounts; mesosternal side-pieces, basal tip of metepisternum and a wide vitta laterally on metasternum, chalky tomentose, the remainder of the metepisternum dark brown. Legs piceous, with ochraceous and gray pubescence intermixed. Antennae with scape piceous, remaining segments dark reddish brown; entirely covered with red ochraceous pubescence.

Head above minutely alutaceous; front very feebly concave between antennal tubercles, surface vertically rugose and finely, densely punctate; genae transverse, coarsely rugosely punctate; eye with lower lobe oblong, very large, more than twice the length of the genae; antennal tubercles feebly prominent, unarmed. Pronotum transverse; sides arcuate; base narrower than apex; apical transverse sulcus deep, strongly curved medially, basal one feebly arcuate; disk with five transverse, glabrous, feebly elevated tubercles medially in a sinuate line, the median one more or less rugose, between these and apical sulcus a sinuate carina; lateral tubercles feeble, obtusely toothed at apex. Scutellum transverse, sides straight, oblique, apex subtruncate. Elytra feebly widened behind middle; apices together rounded; disk on basal half with well-separated, rounded tubercles, those on basal quarter larger and more numerous; remainder of elytra feebly granulate-punctate; humeri prominent, front margin arcuate, at angle a large rounded tubercle. Procoxae globose, not tuberculate; profemora not rugose, simply punctate. Fifth sternite longer than fourth, apex feebly emarginate, and surface at apex feebly, triangularly impressed. Antennae about as long as body, beneath feebly fimbriate to fifth segment; scape feebly clavate to apex.

Length 16 mm., width 5.5 mm.

Holotype: Female; Canal Zone, Barro Colorado; December, 1934; M. Bates, collector; in Museum of Comparative Zoölogy, Cambridge.

Oncideres lyside, new species

Close to *Oncideres minuta* but differs in the following ways: elytral white maculae fewer in number and more widely spaced; basal granules larger, less numerous, and more widely spaced; metasternum white maculate; antennae from fourth segment darker apically.

Male: Elongate-oblong, robust, cylindrical, elytra convex; dark reddish brown, elytra paler; entirely fulvous pubescent. Head with eyes margined with denser fulvous pubescence. Pronotum with five discal glabrous maculae, the two lateral ones more or less coalesced; lateral tubercles glabrous at tip. Scutellum thinly fulvous pubescent. Elytra each with about 18 or 20 rather coarse glabrous maculae, formed by granules, extending nearly to middle; from just before middle to apex with white, rounded, well-spaced maculae (about 18 or 20 larger on each elytron), with a few, very minute ones scattered in between. Beneath reddish brown, yellowish gray pubescent; mesosternal side-pieces ochraceous, metasternum densely, broadly white maculate laterally; sternites laterally on apical margin with a transverse glabrous macula, largest on first sternite, gradually smaller to fifth. Legs dark reddish brown; femora rather thinly, medially denser basally and apically, clothed with ochraceous pubescence. Antennae dark reddish brown, scape and third segment fulvous pubescent; fourth to seventh basally, gradually more narrowly fulvous, apices more broadly dark brown pubescent, segments 8 to 11 dark brown pubescent.

Head above finely, densely punctate; front feebly concave between antennal tubercles, surface moderately, rather densely punctate; genae transverse, coarsely punctate; eye with lower lobe elongate-oblong, more than three times length of gena; antennal tubercles feebly elevated, widely separated, not toothed at apex. Pronotum one and one-half times as wide as long, apex slightly wider than base; apical transverse sulcus broad, deep, strongly recurved medially, basal sulcus shallower, feebly curved medially; disk with five feebly elevated tubercles, all except median one transverse; lateral tubercles feeble, obtuse apically. Scutellum transverse; sides straight, oblique; apex subtruncate.

Elytra with sides very feebly attenuate to apices, which are together rounded, base with from 18 to 20 large, well-spaced granules, reaching to just before middle, those nearest middle slightly less elevated and smaller, remainder of disk very minutely punctate; humeri prominent, with a large, rounded tubercle at angle. Procoxae globose, tumid and rugose anteriorly but not tuberculate; femora robust, profemora broader and simply punctate. Fifth sternite about one-third longer than fourth; apex feebly emarginate. Antennae about one and two-thirds times body length, sparsely fimbriate to sixth, from seventh very sparsely so; scape elongate, slender, feebly clavate to apex, finely, densely punctate.

Length 9.3 mm., width 2.5 mm.

HOLOTYPE: Male; Canal Zone, Barro Colorado; November, 1934; M. Bates, collector; in Museum of Comparative Zoölogy, Cambridge, Massachusetts.

Oncideres laceyi, new species

In the key to species, this runs to *dejeani*, owing to the densely placed, nearly uniformly sized tubercles on the base of the elytra; these, however, in the present form are confined to the basal quarter. Moreover, the elytral maculation is quite distinct, consisting of glabrous punctures medially and including forked lines on the apex. In its affinities it is closest to *multicincta* Dillon and Dillon, from which it differs in the basal granulation, and in the median glabrous maculae of elytra being larger and widely separated; the pubescence above is largely silvery white, variegated with reddish and brown; the pronotum medially is broadly reddish; the median fascia of elytra is mostly silvery, as are the legs. Just behind the humerus on sides of elytra is a very large, projecting tubercle.

FEMALE: Elongate-ovate, robust, black, base of pronotum, apex of elytra, and scutellum fuscous piceous; covered with pubescence. Head and pronotum dull reddish pubescent, variegated somewhat with hoary, especially around occiput and at base and apex of pronotum. Scutellum glabrous (probably rubbed off). Elytra largely silvery white pubescent, variegated irregularly with dull reddish, especially at extreme base; beyond usual smooth area entirely covered by densely placed, contiguous, black granules; from basal quarter to apex with sparse, distinct, rounded, glabrous points; at apical third a broad, nearly glabrous band, consperse with pubescent maculae; from this band to apex run two or three fine, glabrous, forked lines. Body beneath and legs largely hoary, sides of body and legs above broadly tinged or variegated with dull reddish. Antennae fuscous, reddish fulvous pubescent, first three segments entirely and remaining ones beneath, varied with hoary.

Head with front finely punctate and minutely alutaceous; antennal tubercles small, prominent, widely separated, unarmed; eyes with lower lobe elongate-quadrate, slightly taller than genae. Pronotum strongly transverse, with a broad, low tubercle each side behind middle; disk with a single, distinct, transverse, glabrous carina across middle; apical and basal transverse sulci broad, shallow. Scutellum with sides moderately tapering, apex subtruncate. Elytra with sides distinctly tapering, apices together rounded; beyond smooth base densely, finely, contiguously granulate to basal quarter, the granules towards base and around humeri slightly larger, behind and below humerus a very large, projecting tubercle each side; the glabrous points somewhat elevated but otherwise sculpturing concealed to apex; humeri prominent, very broadly rounded. Procoxae with a feeble tubercle anteriorly. Mesosternal process with a distinct tubercle medially (absent in *multicincta*). Fifth sternite nearly twice length of fourth, deeply emarginate at apex, broadly impressed medially. Antennae distinctly shorter than body; sparsely fimbriate beneath to apex; third segment very little longer than scape, which is slender and simple; rest much shorter.

Length 20.5 mm., width 8.3 mm.

HOLOTYPE: Female; Satipo Valley, Junin Province, Peru; June 2, 1945; in L. Lacey collection.

Dedicated to Lionel Lacey of New Rochelle, New York, whose generosity in lending specimens from his collection of Cerambycidae and whose assistance in many other ways have been of value to the authors in their studies.

Clavidesmus rubigineus, new species

While very closely related to *C. heterocera* Buquet, *rubigineus* is distinct in having only the postmedian dark fascia on each elytron; the antennae from fourth segment pale pubescent, with only the apical halves of the fifth, seventh, and ninth, and apex of eleventh, dark brown pubescent; and, especially, in having bright red pubescence intermingled among the yellow and brown on the head, pronotum, base of elytra, the legs, and body beneath.

FEMALE: Elongate-oblong, robust, cylindrical; black, everywhere covered with short dark brown pubescence, variegated with bright red and yellow. Head with a vitta each side of middle of red and yellow, commencing at occiput and continuing to base of front, separating on antennal tubercles, thence gradually converging. Pronotum with a broad, irregular, poorly defined vitta occupying each side of disk, converging anteriorly, largely bright red but including several small patches of yellow pubescence as well; a median line of red and yellow on apical half. Scutellum entirely brown. Elytra largely dull yellow, each with a dark brown, oblique fascia behind middle, variegated with red, and with a vague series of brown blotches basally, extending from near scutellum to suture at middle; extreme base and apex strongly varied with bright red. Body beneath and legs black, largely bright red pubescent, varied somewhat with brown (especially laterally on abdomen) and yellow. Antennae with first three segments and apical halves of fifth, seventh, ninth, and eleventh, and extreme apices of the remainder, black, covered with brown pubescence; rest pale, with hoary pubescence.

Head minutely alutaceous, impunctate; genae rather coarsely, sparsely punctate. Pronotum with basal and apical transverse sulci narrow, the basal one fairly pronounced medially; sides nearly unarmed, bearing only an extremely minute tubercle behind middle. Elytra widened behind middle; entire surface alutaceous, with fairly sparse, rather coarse punctures on basal half, punctures much finer behind middle; humeri slightly prominent, anterior margin arcuate, angle with a feeble, obtuse tubercle. Antennae reaching slightly beyond middle of elytra; scape attaining apex of pronotum, slightly clavate apically; third segment much longer, gradually clavate apically from middle and with a dense tuft of hair there; rest very short, gradually diminishing in length.

Length 16 mm., width 5.6 mm.

HOLOTYPE: Female; Corupa (Hansa Humboldt), Santa Catharina, Brazil; January, 1945; A. Maller, collector.

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NEW BUTTERFLIES FROM MOUNT McKINLEY NATIONAL PARK, ALASKA, WITH A REVIEW OF *EREBIA ROSSII* (RHOPALOCERA, SATYRIDAE)

By Cyril Franklin dos Passos

INTRODUCTION

From the point of view of lepidopterists, one of the most interesting localities in North America is Mount McKinley National Park, Alaska. In this park is situated the highest peak on the continent, Mount McKinley, of which the south pinnacle is 20,300 feet in altitude, and the north peak is only 300 feet lower. The present area of the park is 3030 square miles. The climate of the park differs on the two sides of the Alaska Range. On the inland side there are short, comparatively warm summers and long, cold winters, with little precipitation. The area draining into the Pacific enjoys a more equable climate, the summers being longer and cooler and the winters warmer than in the interior, with much greater precipitation. The park embraces treeless plateaus covered with mosses and grasses, and fertile valleys only 3000 feet in altitude where flowers are plentiful.

Several Rhopalocera have been named from this interesting region, which appears to have a specialized fauna, among them being:

Parnassius eversmanni Men., (race *thor* Hy. Edw.?), tr. f. *kohlsaati* Gunder (1932a, p. 123).
Colias chrysotheme vitabunda Hovanitz (1943, p. 3).
Eurymus chippewa Kirby, form ♀ *kohlsaati* Gunder (1931, p. 45).
Erebia mackinleyensis Gunder (1932b, p. 278).
Erebia youngi rileyi dos Passos (1947, p. 3).

Brenthis (*Clossiana*) *aphirape denali* Klots (1940, p. 413).
Plebius aquilo Bdv., tr. f. *kohlsaati* Gunder (1932a, p. 127).

While two of Gunder's names were proposed as "transition forms" (aberrations), they may become available later in a specific or subspecific sense.

Two more names are proposed in this paper. Unfortunately the data accompanying most of the specimens do not bear any ecological information beyond the elevation at which they were taken. It is probable that they were captured near the park headquarters where there is a hotel and railway station. This locality is on the east side of the park.

All photographs herein reproduced were taken by the author. The figures are about four-fifths natural size.

Oeneis mckinleyensis, new species

Figures 1–12

MALE: Expanse 39–47 mm., holotype 43 mm.

Above, primaries Snuff Brown,[1] Avellaneous, or Tawny Olive (holotype). Costal, outer and part of inner margins with a distinct, narrow line, Bone Brown or Buffy Brown. Prominent triangular patch of dark androconia extending from base of wing to end of cell, partly within cell but mostly along inner margin and outside cell. Base of costa slightly flecked with Avellaneous or Pale Olive Buff scales. Occasionally with faint White subapical dot. Fringes Avellaneous or Pale Olive Buff, cut by Bone Brown or Buffy Brown veins. Secondaries same color as primaries; basal and limbal areas slightly paler; the median band and submarginal band of the under side showing through. Occasionally pale submarginal markings between the veins. Marginal line and fringes as on primaries.

Below, primaries same color as above but paler. Apex flecked with Gray scales. Occasionally with one or more faint White submarginal dots between the veins. Faintly outlined median band somewhat produced beyond the cell, the androconia distinctly showing through. Aniline Yellow veins from basal to limbal areas. Marginal line and fringes as above. Secondaries with a broad, irregular, Verona Brown or Wood Brown median band, outlined with Carob Brown, more even on the inner side, separated from a darker basal area by an area flecked more or less with Gray, especially adjoining the median band. The median band arises in the center of the costa and terminates at the anal angle. It is separated from an indistinct, irregular, Wood Brown submarginal band by a prominent Gray area, paler next to the median band. Costa flecked with Verona Brown or Wood Brown and Gray. Aniline Yellow veins merging to Gray beyond the median band. Marginal line and fringes as on primaries.

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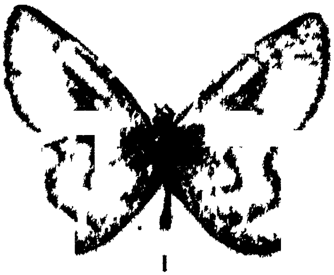
[1] All color terms are those employed in "Color standards and color nomenclature" by Robert Ridgway, Washington, D. C., 1912, published by the author.



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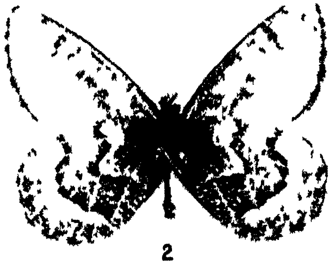

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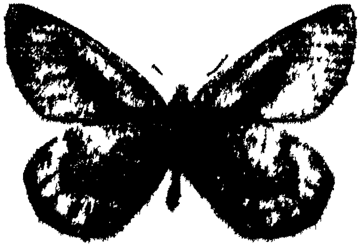

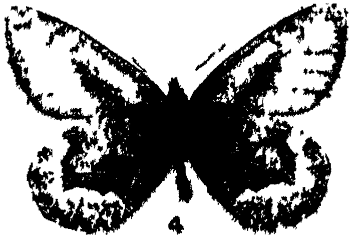

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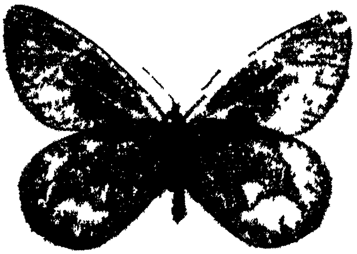
FIGS. 1-2. *Oeneis mckinleyensis* dos Passos, paratype male, upper and under sides.

FIGS. 3-4. *Oeneis mckinleyensis* dos Passos, holotype male, upper and under sides.

Head concolorous with wings on upper side; eyes Cinnamon-Rufous; antennae Capucine Orange ringed with Black; palpi White with Black hairs; thorax Black covered with hairs concolorous with wings on upper side, hairs Black on under side; legs Mouse Gray; abdomen hairy, concolorous with wings.

FEMALE: Expanse 39.5–48 mm., allotype 47 mm.

Above, primaries Prout's Brown, Chamois, or Isabella Color (allotype). Marginal area somewhat darker. Costal, outer and part of inner margins with a distinct, narrow line, Bone Brown or Buffy Brown. Base of costa slightly flecked with Avellaneous or Pale Olive Buff scales. Occasionally with a faint White subapical dot. The outlined median band on the under side faintly showing through. Fringes Avellaneous or Pale Olive Buff, cut by Bone Brown or Buffy Brown veins. Secondaries same color as primaries; basal and limbal areas slightly paler; the median band and submarginal band of the under side showing through. Occasionally pale submarginal markings between the veins. Marginal line and fringes as on primaries.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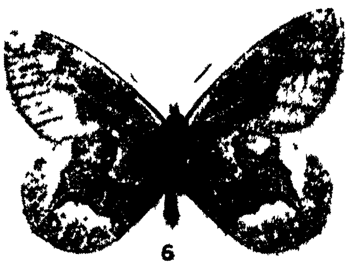
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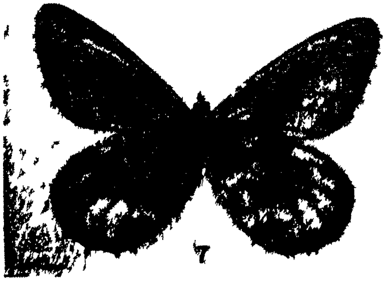
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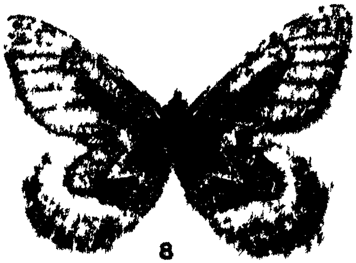
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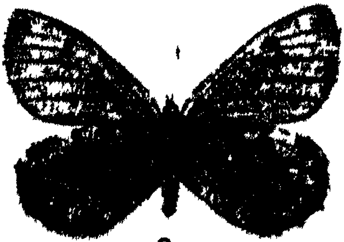
FIGS. 5–6. *Oeneis mckinleyensis* dos Passos, paratype male, upper and under sides.

FIGS. 7–8. *Oeneis mckinleyensis* dos Passos, paratype male, upper and under sides.

Below, primaries same color as above but paler. Apex flecked with Gray scales. Occasionally with one or more faint White submarginal dots between the veins. Faintly outlined median band somewhat produced beyond the cell. Aniline Yellow veins from basal to limbal areas. Marginal line and fringes as above. Secondaries with a broad, irregular, Verona Brown or Wood Brown median band, outlined with Carob Brown, more even on the inner side, separated from a darker basal area by an area flecked more or less with Gray, especially adjoining the median band. The median band arises in the center of the costa and terminates at the anal angle. It is separated from an indistinct, irregular, Wood Brown submarginal band by a prominent Gray area, paler next to the median band. Costa flecked with Verona Brown or Wood Brown and Gray. Aniline Yellow veins merging to Gray beyond the median band. Marginal line and fringes as on primaries.



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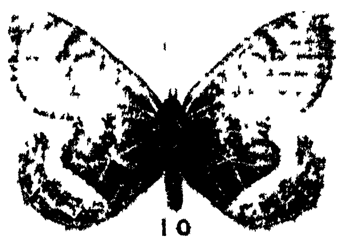

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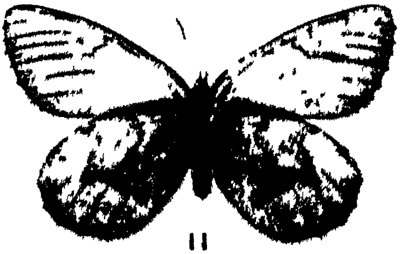

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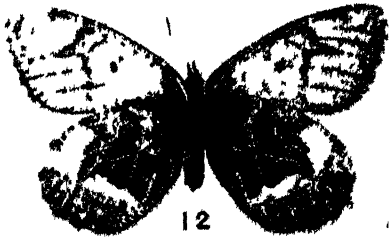

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FIGS. 9 10. *Oeneis mckinleyensis* dos Passos, paratype female, upper and under sides.

FIGS. 11 12. *Oeneis mckinleyensis* dos Passos, allotype female, upper and under sides.

Head, eyes, antennae, palpi, thorax, legs, and abdomen similar to male.

The shape of the median band on the under side of the secondaries of both sexes, especially the males, is extremely variable. For that reason it has been thought desirable to figure three male and one female paratypes in addition to the holotype and allotype. From these figures it will be seen that the band may be rounded or produced far beyond the cell. In one extreme case (figs. 7, 8) the band has an extraordinary zigzag design. Of a series of 79 males examined, 35 have the median band produced to a sharp point beyond the cell, while 44 do not show this character. From a series of 30 females, the band is similarly produced beyond the cell in 19 specimens and not produced in 11 specimens. Taking males and females together, there are 54 specimens in which the band is produced and 55 in which it is not, as equal a division as could be made with an odd number. At first sight it might be thought that two different species were involved, but dissections have shown that such is not the fact.

The genitalia are of the type of *Oeneis taygete* Geyer ([1830], pl. [17]), i.e., the clasp has one prominent tooth pointing distally and projecting from near the center of the costa.

This new species is nearest in superficial appearance to *Oeneis hanburyi* Watkins (1928, p. 617), but differs in the following respects:

1. In series it is considerably larger. The holotype of *mckinleyensis* expands 43 mm., while some specimens expand 47 mm. A paratype of *hanburyi* in the American Museum of Natural History expands only 41.5 mm.
2. The androconia on the upper side of the primaries are dark, and the patch is prominent. In *hanburyi* these scales are only slightly darker than the ground color of the wings.
3. The median band is wider, the adjoining areas are lighter, and there are fewer striations, especially in the females. This band is often produced far beyond the cell, while in *hanburyi* that is hardly ever, or at most only slightly, the case.
4. The clasp of *mckinleyensis* is longer, narrower, and less pointed. In *hanburyi* the clasp is more triangular. However, this distinction is based only upon the dissection of the paratype of *hanburyi* and nine specimens of *mckinleyensis*. The latter are uniform in the respect noted.

Several other species of *Oeneis* fly at or about the same time as *mckinleyensis*, June 15 to July 30, and apparently in the same general locality. These facts, however, require confirmation, especially the precise habitats where these insects occur. Only one specimen of *taygete* has been seen from Mount McKinley. That specimen is dated July, 1925, and is from the Sweadner Collection in the Carnegie Museum, Accession 12938. It was kindly lent to the author by Dr. Walter R. Sweadner, Curator of Entomology. Also seen from the same general locality is a long series of *Oeneis brucei yukonensis* Gibson (1920, p. 15i) taken between June 8 and August 1, 1929 and 1932. Future collectors in the Mount McKinley National Park area should give careful attention to the elevations at which the various species occur, their habitats, and gather other ecological information. It is to be hoped that such information will be published, and that some progress will be made towards ascertaining the life histories of the butterflies described from this region.

TYPE MATERIAL: The holotype male is from McKinley Park, Alaska, June 19, 1932, and the allotype female is from Mount McKinley Park, Alaska, July 20, 1932. There are 12 pairs of paratypes from Alaska as follows: 4 males and 7 females, McKinley Park, June 16–July 15, 1932; 3 males and 2 females, Mount McKinley Park, July 3–July 20, 1932, and 1 female, same locality, 3500 feet, July 5, 1938, *ex* collection G. P. Engelhardt; 2 males, McKinley National Park, June 20, 1930 (genitalic slide no. 199, C. F. dos Passos) and June 21, 1930; 3 males, McKinley, June 16, 1930 (genitalic slide no. 66, C. F. dos Passos), June 18, 1930 (genitalic slide no. 197, C. F. dos Passos), and June 25, 1930 (genitalic slide no. 186, C. F. dos Passos), and 2 females, same locality, June 20 and July 7, 1930. The holotype and allotype are in the American Museum of Natural History, *ex* collection C. F. dos Passos. One pair of paratypes each will be sent to the British Museum (Natural History), the Canadian National Collection, the Carnegie Museum, and the United States National Museum. The remaining paratypes are in the collection of the author.

ADDITIONAL MATERIAL EXAMINED: Twenty-one males and 5 females, Mount McKinley Park, June 27-July 27, 1932, and 4 males and 2 females, same locality, 3500 feet, July 5, 1938, *ex* collection G. P. Engelhardt (one male genitalic slide no. 187, C. F. dos Passos); 2 males, McKinley Park, July 29, 1930, *ex* collection D. Fraser (genitalic slides nos. 13 and 14, C. F. dos Passos), and 26 males and 9 females, same locality, June 15–July 25, 1932 (two male genitalic slides nos. 188 and 200, C. F. dos Passos); 1 male, McKinley National Park, June 28, 1930; 1 male, Mount McKinley, July 30, 1929; 10 males and 1 female, McKinley, June 16–30, 1930, all in the collection of the author; 7 males and 11 females, Mount McKinley National Park, June 16–July 28, 1930 (F. Morand), *ex* collection J. D. Gunder, Accession 34998; 3 males and 2 females, McKinley Park, July 28-August 3, 1930, *ex* collection D. Fraser, Accession 32500, and 1 female, same locality, July 29, 1930; 1 male, Mount McKinley, July 15–30, 1930, *ex* collection J. D. Gunder, Accession 34998; 12 males, McKinley, July 2–28, 1930, *ex* collection J. D. Gunder, Accession 34998; 2 males and 2 females, Alfred Creek Camp, Alaska, July 15 and 26, 1922, 3000 feet (R. A. Pope), and 2 males and 1 female, same locality, July 15, 1922, *ex* collection R. Ottolengui, Accession 31373; 6 males and 1 female, Boulder Creek, Alaska, June 26, 1922 (R. A. Pope); 1 male, Teller, Alaska, July 18, 1928, Accession 29316; 1 male, east end Clinton Colden Lake, Mackenzie, Northwest Territories, August 10, 1907 (E. T. Seton and E. A. Preble), all in the American Museum of Natural History; 1 male, June 19, 1930, McKinley National Park, *ex* collection H. Engel, Accession 13257, in the Carnegie Museum.

Erebia rossii rossii (Curtis)

Hipparchia Rossii CURTIS, [1835], *in* Ross, Narrative of a second voyage in search of a north-west passage, app., p. 67, pl. A, fig. 7.

Ereb[ia] Rossii, WESTWOOD, 1851, Genera of diurnal Lepidoptera, vol. 2, p. 380.

Erebia Rossii, BUTLER, 1868, Catalogue of diurnal Lepidoptera . . . family Satyridae in the . . . British Museum, p. 89.

M[aniola] Rossii, KIRBY, 1871, A synonymic catalogue of diurnal Lepidoptera, vol. 1, p. 67.

Erebia Rossii, EDWARDS, 1872, Synopsis of North American butterflies, p. 26.

Erebia Rossii, SCUDDER, 1875, Bull. Buffalo Soc. Nat. Sci., vol. 2, p. 243.

Erebia Rossii, EDWARDS, 1877, Trans. Amer. Ent. Soc., vol. 6, p. 34.

Erebia Rossii, STRECKER, 1878, Butterflies and moths of North America, p. 152.

Erebia Rossii, EDWARDS, 1884, Trans. Amer. Ent. Soc., vol. 11, p. 289.

Erebia disa ?var. vel. bona sp. *rossi*, ELWES, 1889, Trans. Ent. Soc. London, p. 330.

Erebia Rossii, SKINNER, 1898, A synonymic catalogue of the North American Rhopalocera, p. 35.

Erebia rossii, ELWES, 1898, Trans. Ent. Soc. London, p. 202.

Erebia rossii, ELWES, 1899, *ibid.*, p. 348.

Erebia rossii, ELWES, 1903, *ibid.*, p. 240.

Erebia rossii, CARY, 1906, Proc. U. S. Natl. Mus., vol. 31, p. 448.

E[rebia] rossii, EIFFINGER (*nec* Curtis), 1908, *in* Seitz, Macrolepidoptera of the world, vol. 1, p. 109.

E[rebia] rossii, WEYMER, (*partim*), 1911, *in* Seitz, Macrolepidoptera of the world, vol. 5, p. 238.

Erebia rossi, GIBSON, 1920, Report of the Canadian Arctic expedition 1913–18, vol. 3, pt. 1, p. 17i, pl. 4, fig. 9.

E[rebia] rossii, GOLTZ (*nec* Curtis), 1930, *in* Seitz, Macrolepidoptera of the world, suppl. 1, p. 150, pls. 9g, 9h.

Erebia rossi, HOLLAND, 1931, The butterfly book, revised ed., p. 203, pl. 73, figs. 3, ♂, 4, ♀, under side.

Erebia rossi, HOLLAND AND AVINOFF, 1935, Mem. Carnegie Mus., vol. 12, pt. 2, sect. 5, p. 7, pl. 18, figs. 16–18.

Erebia rossii, LEUSSLER, 1935, Bull. Brooklyn Ent. Soc., vol. 30, pp. 50–51.

Erebia rossii, WARREN, 1936, Monograph of the genus *Erebia*, p. 158.

E[*rebia*] *rossii rossii*, WARREN, 1936, *op. cit.*, p. 159, pl. 73, figs. 925, 928, 931, 934, genitalia pl. 32, figs. 308–309.

Erebia rossii, McDUNNOUGH, 1937, Canadian Ent., vol. 69, pp. 14–15.

Erebia rossii, DOS PASSOS, 1939, Bull. Cheyenne Mt. Mus., vol. 1, pt. 2, p. 8–12.

This insect was described from a series of five specimens taken on Boothia Felix (now called Boothia Peninsula) by Commander James Clark Ross on July 18 and 25, 1830, and July 14, 1831. The number of each sex is not given in the original description, but since both the male and the female are described, and the male is figured, there must have been at least one of each sex.

The United States National Museum has three of the five types of *rossii rossii*, all apparently females. Attached to one is a legend in French, as follows:

> "Voy. du Cap. Ross. p. lxvii. pl. A. f. 7.
>
> "Pôle. Voyage du Cap. Ross. Donné par M. Doubleday qui les tenait de M. Curtis lui même l'etiquette çi-dessous de la propre main de ce dernier.
>
> "Cinq individus seulement ont été raportés par le Capitaine Ross qui les a pris du 14 au 28 juillet sur les rochers abruptes et les pierres détachées òu ils étaient rares.
>
> "Le No. 1 m'apparait être un ♂ si je considère les ailes et cependant l'abdomen est d'une ♀ ! aurait-il été changé? J'en doute car ces trois individus étaient fort maltraités quand M. Doubleday m'a envoyé cette précieuse espèce. Cependant la description de M. Curtis fait également supposer un ♂. quant aux N^{rs}. 2 et 3 ce sont évidemment deux ♀.
>
> "On voit parce que j'ai dit plus haut combien est précieuse cette boite espèce que personne en France en possède et même n'a vue et que ne figure dans aucun catalogue.
>
> "Elle est parente des Ereb. Embla et Disa, mais bien distincte."

I am indebted to Mrs. Richard Leroy Schuster of New York City for her assistance in deciphering the difficult orthography of the original label.

These three specimens were acquired by the United States National Museum through the purchase of the collection of William Barnes, who in turn obtained them from the collection of Charles Oberthür, when Barnes purchased the types of North American Rhopalocera in that collection. Before that time they were probably in the collection of Achille Guenée, who is believed to have been the author of the above-quoted legend. According thereto, the handwritten labels attached to the specimens were written by Curtis.

As observed by McDunnough (*tom. cit.*, p. 15), this subspecies is " . . . characterized by the small ocelli of forewings (mostly confined to the two subcostal ones) and the general indistinct nature of the banding on the underside of the hind-wing." The subapical ocelli sometimes are missing, or very indistinct. The marginal band on the under side of the secondaries is greatly obscured in typical *rossii rossii.*

DISTRIBUTION: The habitat of this subspecies is along the northern fringe of the continent from the Mackenzie Delta to southern Baffin Island, inland for an unknown distance in the Barren Grounds, and on Southampton Island in Hudson Bay.

MATERIAL EXAMINED: Two males and 2 females, Southampton Island, Hudson Bay, July 18, 1930 (G. M. Sutton), Accession 8925 in the Carnegie Museum; 1 male, same data, (genitalic slide no. 260, C. F. dos Passos), in the collection of the author, *ex* collection Carnegie Museum; 14 males and 1 female, Coppermine, Northwest Territories, July 17–18, 1947, and 2 males, Dismal Lakes, Northwest Territories, July 19, 1947, all collected by, and in the collection of, William Hovanitz.

Erebia rossii ornata Leussler

Figures 13–16

Erebia rossii Curtis race *ornata* LEUSSLER, 1935, Bull. Brooklyn Ent. Soc., vol. 30, p. 50.

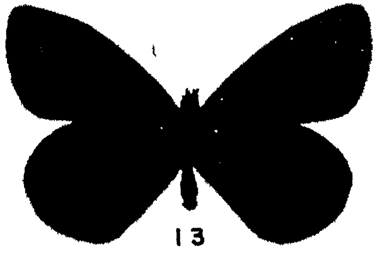
Erebia rossii ornata, McDUNNOUGH, 1937, Canadian Ent., vol. 69, p. 15.

Erebia rossii ornata, DOS PASSOS, 1939, Bull. Cheyenne Mt. Mus., vol. 1, pt. 2, p. S–12.

This insect was described from a series of 16 males and nine females taken at Churchill, Manitoba, Canada, by Owen Bryant, between June 15 and 20, 1930. The holotype male and allotype female are in the collection of the Ohio State University, Columbus, Ohio, *ex* collection R. A. Leussler, *ex* collection O. Bryant.

This subspecies usually may be distinguished from the other subspecies of *rossii* by the fact that the two subapical ocelli on the upper side of the primaries almost invariably fuse into one rather large ocellus. The band on the under side of the secondaries is obscure as in *rossii rossii.* These characters are well shown by the figures of a pair of paratypes of *ornata* (figs. 13–16) in the collection of the author. The types never have been figured.

DISTRIBUTION: Thus far this subspecies has been seen only from Churchill, with the exception of a single male from "Minniota" [Miniota]; Manitoba, June 10, 1926, in the collection of the present author, as to which the data may be incorrect.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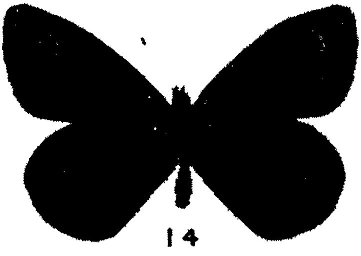
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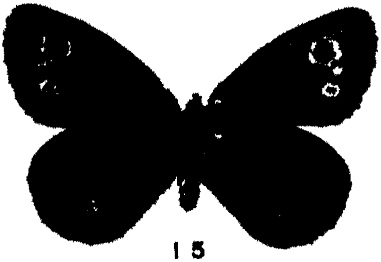
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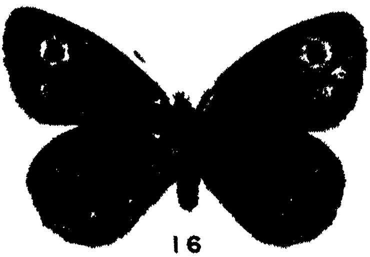
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FIGS. 13–14. *Erebia rossii ornata* Leussler, paratype male, upper and under sides.

FIGS. 15–16. *Erebia rossii ornata* Leussler, paratype female, upper and under sides.

Erebia rossii kuskoquima Holland

Erebia rossii, SKINNER, 1899, Ent. News, vol. 10, p. 113.

Erebia rossi [*sic*] (Curtis) Var. *kuskoquima* HOLLAND, 1931, The butterfly book, revised ed., p. 203, pl. 61, figs. 21, ♂, 22, ♀, 23, ♀, under side.

Erebia rossi variety *kuskoquima*, HOLLAND AND AVINOFF, 1935, Mem. Carnegie Mus., vol. 12, pt. 2, sect. 5, p. 8.

Erebia rossii race *kuskoquima*, LEUSSLER, 1935, Bull. Brooklyn Ent. Soc., vol. 30, pp. 50–51.

E[*rebia*] *rossii* ssp. *erda* f. *kuskoquima*, WARREN (*nec* Holland), 1936, Monograph of the genus *Erebia*, p. 161.

Erebia rossii kuskoquima, MCDUNNOUGH, 1937, Canadian Ent., vol. 69, pp. 14–15.

Erebia rossii kuskoquima, DOS PASSOS, 1939, Bull. Cheyenne Mt. Mus., vol. 1, pt. 2, p. 8–12.

The types of *kuskoquima* were collected by A. Stecker, who was in charge of the Moravian Mission to the Eskimos on the Kuskokwim River, Alaska. Dr. Sweadner was kind enough to supply the information that Stecker's base station was located at Bethel, about 20 miles up the Kuskokwim River at the inland edge of the coastal tundra, and that most of Stecker's collecting was done there and down the river towards its mouth.

Holland neglected to label the types of this subspecies. When the types of North American Rhopalocera in the Carnegie Museum were photographed in 1938 after Holland's death, this omission was discovered. Thereupon after consultation with Dr. A. Avinoff, then director of that museum, the present author on February 17, 1938, labeled as the types the three specimens figured by Holland (*loc. cit.*).

The male, referred to above, is hereby designated the lectotype of *Erebia rossi* (Curtis) var. *kuskoquima* Holland, and will be labeled accordingly.

As observed by Holland (*op. cit.*, p. 203), "The extradiscal band on the lower side of the secondaries, which in the typical form is obscure, is lighter . . . ," and as McDunnough (*tom. cit.*, p. 15) remarks, " . . . the basal area is also much lighter and in consequence the median dark band stands out quite prominently."

Warren (*in litt.*) agrees with the present author that his figures (*op. cit.*, pl. 73, figs. 928, 934) of "*kuskoquima*" should be referred to *rossii rossii*. He does not figure *kuskoquima*. McDunnough (*loc. cit.*) already had pointed out this fact. Warren's other figures (*op. cit.*, pl. 73, figs. 926, 932, pl. 74, figs. 935, 941, genitalia pl. 32, figs. 310–312) of "*kuskoquima*" should be referred to the Palaearctic subspecies.

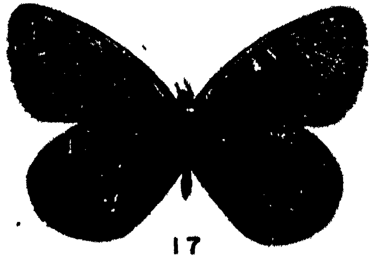
DISTRIBUTION: Thus far this subspecies is known only from the Kuskokwim River Valley, Alaska.

Erebia rossii gabrieli, new subspecies

Figures 17–28

MALE: Expanse 38.5–50 mm., holotype 48 mm.

Above, primaries and secondaries Light Seal Brown, Auburn, or Mummy Brown (holotype). The primaries seldom without ocelli; usually with two subapical ocelli and sometimes with one to two submarginal Orange or Orange Buff spots. The ocelli are joined and circled with Orange or Orange Buff, and Black pupiled, slightly elongated, the Black pupils seldom joined. Secondaries usually without ocelli, but in a few instances with one to four Orange or Orange Buff spots, some with, but usually without, minute Black pupils. Fringes Gray.



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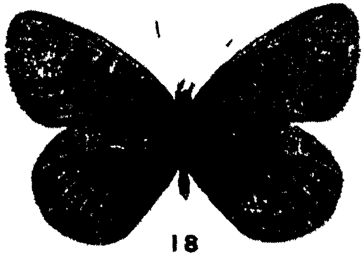

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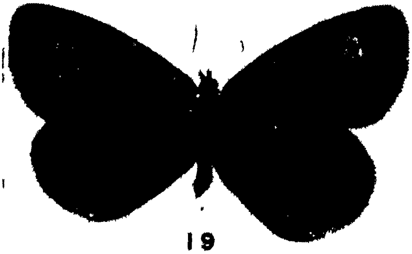

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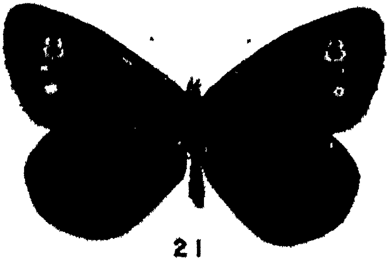

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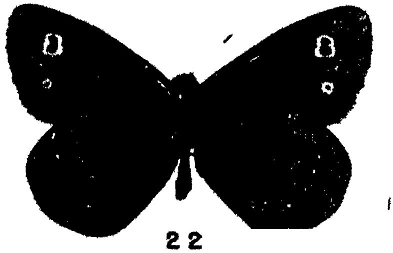

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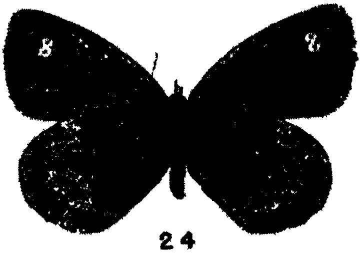
Figs. 17 18. *Erebia rossii gabrieli* dos Passos, paratype male, upper and under sides.

Figs. 19 20. *Erebia rossii gabrieli* dos Passos, holotype male, upper and under sides.

Figs. 21 22. *Erebia rossii gabrieli* dos Passos, paratype male, upper and under sides.

Below, primaries, basal, and discal areas Bay or Chestnut. Costal and limbal areas Mars Brown or Chestnut Brown. Apex flecked with Gray scales. The ocelli reappearing usually with minute White points. Secondaries, basal, and limbal areas Cinnamon-Drab or Ecru-Drab flecked with Gray, separated by a broad, irregular, Hessian Brown or Chestnut Brown median

23



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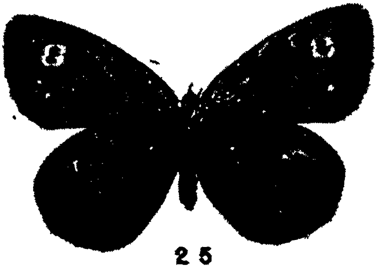

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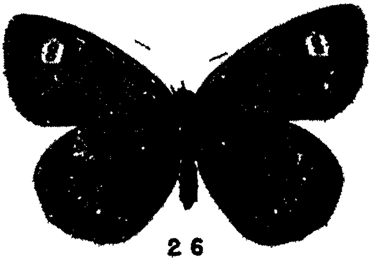

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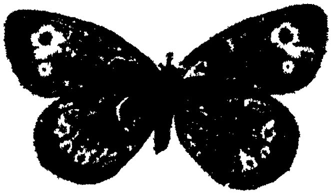

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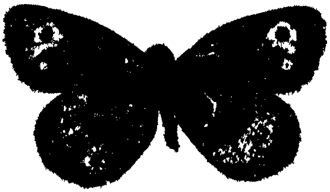

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FIGS. 23–24. *Erebia rossii gabrieli* dos Passos, paratype female, upper and under sides.

FIGS. 25–26. *Erebia rossii gabrieli* dos Passos, allotype female, upper and under sides.

FIGS. 27–28. *Erebia rossii gabrieli* dos Passos, paratype female, upper and under sides.

band lightly flecked with Gray scales. Crenulate marginal band same color as median band. Fringes as above.

Head and eyes Black, the former covered with Black hairs; antennae annulated, Orange and Black, club tipped with Black; thorax and abdomen Black, hairy; legs somewhat paler than wings.

FEMALE: Expanse 40–46 mm., allotype 45 mm.

Above, primaries and secondaries Mummy Brown, Prout's Brown, or Auburn (allotype). The primaries with two subapical Orange or Orange Buff ocelli pupiled with Black; some specimens with one or two additional Orange or Orange Buff submarginal spots on the primaries. Usually only the subapical ocelli have Black pupils. The allotype has an Orange scale or two in the subapical ocelli. Secondaries with none to occasionally four small submarginal ocelli sometimes pupiled with Black. Fringes Gray.

Below, primaries, basal, and discal areas Burnt Sienna, Snuff Brown, or Tawny Olive. Costal and limbal areas Mars Brown, Chestnut Brown, or Snuff Brown. Apex flecked with Gray scales. The ocelli reappearing usually with minute White points. Secondaries, basal, and limbal areas Wood Brown or Fawn Color flecked with Gray, separated by a broad, irregular, Chestnut Brown or Natal Brown median band lightly flecked with Gray scales. Crenulate marginal band same color as median band. Fringes as above.

Head, eyes, antennae, thorax, abdomen, and legs similar to male.

Two males in the collection of the author deserve special mention. One has the usual pair of ocelli on the upper side of left primary. On the right primary there are four ocelli in an Orange Buff submarginal band. The other specimen is marked in the same way, but the markings are on the opposite wings.

Of a series of 139 males examined, 63 have three or more ocelli or spots on the primaries, 64 have two ocelli, and 12 have one or none. A series of 21 females reveals four with four or more ocelli or spots on the primaries, 10 with three ocelli, and seven with two. Usually large and numerous ocelli or spots on the primaries are offset by similar markings on the secondaries.

This subspecies is named for my friend A. G. Gabriel, Assistant Keeper, Department of Entomology, British Museum (Natural History). The author is indebted to Mr. B. C. S. Warren for kindly examining specimens of the new subspecies and advising that in his opinion it is worthy of a name.

The new subspecies differs from *rossii rossii* in that the two subapical ocelli on the upper side of the primaries are larger, and the median band on the under side of the secondaries is more prominent. In *rossii rossii* this band is barely visible. It differs from *ornata* in that the two subapical ocelli are usually smaller and seldom fuse into one. The dark median and marginal bands on the under side of the secondaries are usually narrower. It differs from *kuskoquima*, its nearest relative, in that the median band on the under side of the secondaries is narrower, the pale area between that band and the dark marginal band is wider and somewhat darker, thus leaving the marginal band somewhat narrower. The females very seldom have as many large and conspicuous ocelli on the upper side of the wings, especially on the secondaries. The genitalia of these four subspecies have been examined, but do not appear to show any constant differences.

DISTRIBUTION: The habitat of this subspecies is in the Alaska Range, where it seems to fly at about 3500 feet elevation. A large portion of this range is in Mount McKinley National Park. No substantial barrier appears to exist between *kuskoquima* and *gabrieli*, and the latter is perhaps but an altitude subspecies.

TYPE MATERIAL: The holotype male is from Mount McKinley Park, 3500 feet, Alaska, July 5, 1938, *ex* collection G. P. Engelhardt, and the allotype female is from the same locality, July 17, 1932. There are 20 pairs of paratypes from Alaska as follows: 3 males and 11 females, Mount McKinley Park, between June 21 and July 26, 1932, and 2 females, same locality, 3500 feet, July 5, 1938, *ex* collection G. P. Engelhardt; 1 male, McKinley National Park, June 28, 1930; 10 males and 7 females, McKinley Park, between June 17 and July 24, 1932; 6 males, McKinley, June 20 and 25, 1930. The holotype and the allotype are in the American Museum of Natural History, *ex* collection C. F. dos Passos. One pair of paratypes is in the Canadian National Collection. One pair of paratypes each will be sent to the British Museum (Natural History), the Carnegie Museum, and the United States National Museum. The remaining paratypes are in the collection of the author.

ADDITIONAL MATERIAL EXAMINED: The author has examined also the following specimens of *gabrieli* from Alaska, but they are not made paratypes: 83 males, Mount McKinley Park, between June 27 and July 22, 1932, and 1 male, same locality, 3500 feet, June 5, 1938, and another male, same locality and elevation, July 5, 1938, the latter two *ex* collection G. P. Engelhardt; 1 male, McKinley Park, June 20, 1930, and 30 males, same locality, between June 19 and July 25, 1932; 1 male, McKinley, June 30, 1930, all in the collection of the author; 1 male, McKinley Park, July 29, 1930, *ex* collection D. Fraser, Accession 32500; 6 males, McKinley, June 7–20, 1930, and 16 males and 7 females, same locality, June 20–July 9, 1930, *ex* collection J. D. Gunder, Accession 34998, all in the American Museum of Natural History.

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ECHINODERMS OF TARUT BAY AND VICINITY, SAUDI ARABIA

By Austin H. Clark

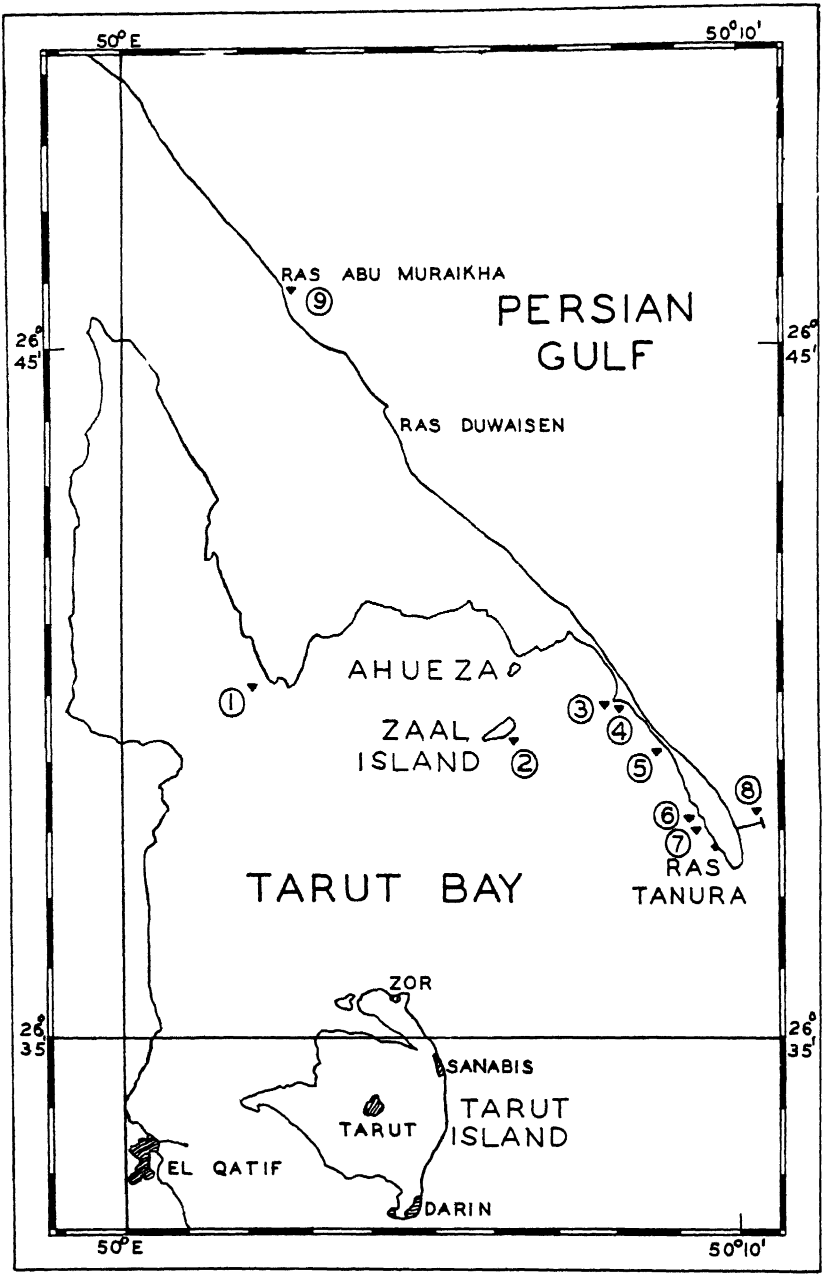
WITH NOTES ON THEIR OCCURRENCE

By Richard LeBaron Bowen, Jr.

Between February 10, 1945, and August 30, 1947, Mr. Richard LeBaron Bowen, Jr., made a small but very interesting collection of echinoderms in Tarut Bay, Saudi Arabia, and vicinity. Tarut Bay, cut off from the Persian Gulf by the promontory of Ras Tanura (Tannura or Tannurah), lies in latitude 26° 35′ N., longitude 50° 00′ E. Its location on maps of Arabia is marked by the town of El Qatif (Katif or Kateef).

Although the number of species is small, including only three starfishes, six brittle-stars, and six sea-urchins, Mr. Bowen regards it as complete for the species living in the littoral fringe, except for the rarer or more elusive forms.

Of special interest in connection with this collection are Mr. Bowen's extensive notes on the occurrence of these animals. Noteworthy is the abundance of *Metalia townsendi*, *Clypeaster humilis*, and *Lovenia elongata* along the shores in this region. With these, and with the equally abundant *Echinodiscus auritus*, Mr. Bowen found the small symbiotic brittle-star *Amphilycus androphorus*, which has not been reported since its discovery at Lourenço Marquez. For the first time the needle-urchin (*Diadema*) was found in the Persian Gulf, though its occurrence there was to be expected. Just what species is represented must be left for future determination, as no specimens were collected.


50° E
50°10'
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RAS ABU MURAIKHA
⑨
PERSIAN GULF
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AHUEZA
①
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ZAAL ISLAND
②
⑤
⑧
⑥
⑦
RAS TANURA
TARUT BAY
ZOR
SANABIS
TARUT
TARUT ISLAND
EL QATIF
DARIN
50° E
50°10'

STATION LIST

STATION[1]	LOCALITY	DATE
1	Tarut Bay, rocky bottom on upper Tarut Bay	March 7, 1947
2	Tarut Bay, approaches to Zaal Island	February 21, 1947
3	Tarut Bay, rocky point jutting off Ras Tanura Peninsula	May 25, 1945 December 13, 1946
4	Tarut Bay, rocky point jutting off Ras Tanura Peninsula	February 7, 1947
5	Tarat Bay, shores of Ras Tanura Peninsula	February 6, 1947 April 19, 1947 April 20, 1947
6	Tarut Bay, four sand bars off Ras Tanura Peninsula	January 10, 1947
7	Tarut Bay, sand bar off Ras Tanura Peninsula	December 23, 1946 December 27, 1946 February 4, 1947
8	Persian Gulf, in 40 feet of water	March 30, 1947
9	Persian Gulf, Rocky Point	May 30, 1947

ASTEROIDEA

Astropecten polyacanthus Müller and Troschel

LOCALITY: Station No. 6A, buried in the sand; January 10, 1947. Two specimens.

NOTES: In these two specimens R = 34 and 30 mm. In both all the superomarginals carry a well-developed erect spine, that on the first largest, those from the second onward decreasing gradually and regularly in height to the end of the ray.

Astropecten pugnax Koehler

LOCALITY: Station No. 6A, buried in the sand; January 10, 1947. One specimen.

NOTE: In this specimen R = 47 mm.

Asterina cephea var. **iranica** Mortensen

LOCALITY: Station No. 5, on under side of rocks; February 6, 1947. Two specimens.

NOTES: The larger specimen has R = 27 mm., r = 11 mm. There are six spines on the oral surface of each jaw plate, in one case seven. In the smaller specimen R = 23 mm., r = 10 mm.

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[1] For the location of these stations, see the map on opposite page.

OPHIUROIDEA

Ophiothrix hirsuta Müller and Troschel

LOCALITIES: Station No. 4, in pools under rocks; February 7, 1947. Two specimens.

Station No. 2, underneath rocks; February 21, 1947. Two large specimens.

NOTES: The larger specimen from Station No. 4 has the disk slightly stellate, 18 mm. in diameter, and the arms 270 mm. long. The arms above have a conspicuous median white stripe bordered with black; beyond these black borders there is, in the outer part of the arm, an indefinite light stripe on either side. Beneath the arms are dark brown becoming deep purple distally with a conspicuous median white stripe. The arm spines are short, not twice the width of the arm in length.

In a smaller specimen from the same locality the white median line above is indistinctly margined with dark and the arms below are white, the under arm plates in the outer part of the arm laterally clouded with dusky.

I follow Mortensen in referring these specimens from the Persian Gulf to *O. hirsuta*. They agree with Koehler's figure of a specimen in his collection from the Red Sea, though in color they agree well with Dr. H. L. Clark's *O. rhabdota* from the Murray Islands in Torres Strait. The hook formed by the first arm spine is variable, the type characteristic of *O. hirsuta* and that characteristic of *O. longipeda* being found in the same specimen. It seems doubtful if *hirsuta* and *rhabdota* are really distinct from *longipeda*.

Ophiothrix savignyi (Müller and Troschel)

LOCALITIES: Station No. 5, in pools under rocks; February 6, 1947.

Station No. 4, in pools under rocks; February 7, 1947.

Station No. 2, in pools under rocks; February 21, 1947.

Station No. 1, in pools under rocks; March 7, 1947.

Station No. 8, in 40 feet of water; March 30, 1947.

In all, 97 specimens.

NOTE: Like many of its relatives, this species is very variable in its color pattern.

Amphilycus androphorus Mortensen

LOCALITIES: Station No. 6A; January 10, 1947. One female.

Station No. 6D; January 10, 1947. One pair.

NOTES: The female of this small symbiotic species carries the dwarf male mouth to mouth, the arms of the male alternating with those of the female and wrapped around her disk.

This species was described by Th. Mortensen in 1933 from specimens taken by him at Polana Beach, Lourenço Marquez. He found it living on *Echinodiscus bisperforatus*, usually near the slits, more rarely near the mouth.

The specimens from Station No. 6D, a female with an attached male, are from the same station as some specimens of *Clypeaster humilis*, with which they were probably associated in life.

The specimen from Station No. 6A is a female from which the male has become detached. The disk is 3 mm. in diameter. This specimen is curious in having all the brilliancy of a glass model, appearing as if silicified. It was found on *Metalia townsendi.*

Ophionereis dubia (Müller and Troschel)

LOCALITY: Station No. 2, in pools under rocks; February 21, 1947. Three specimens.

Ophiactis savignyi (Müller and Troschel)

LOCALITY: Station No. 8, in 40 feet of water; March 30, 1947. One small specimen.

Ophiopezella fallax (Peters)

LOCALITY: Station No. 2, underneath rocks; February 21, 1947. Two specimens.

Station No. 1, underneath rocks; March 7, 1947. One specimen.

NOTES: The two specimens from Station No. 2 have the disk 14 mm. in diameter and the arms 40–45 and 50 mm. long. One shows small, bare, appleseed-shaped radial shields with usually three small bare plates arranged in a triangle between them; the center plate in the rows of enlarged marginal plates between the arms is bare.

The specimen from Station No. 1 has the disk 14 mm. in diameter and the arms 47 mm. long.

ECHINOIDEA

Temnopleurus toreumaticus (Leske)

LOCALITY: Station No. 7, buried in the sand; December 23, 1946. Two specimens 28 and 36 mm. in diameter.

Echinometra mathaei (De Blainville)

LOCALITIES: Station No. 3, on top of rocks; May 25, 1945. Three specimens.

Station No. 4, under rocks; February 7, 1947. Two small specimens.

Echinodiscus auritus Leske

LOCALITIES: Station No. 3, buried in muddy sand; May 25, 1945. Three specimens.

Station No. 6A, buried in the sand; January 10, 1947. One specimen.

Station No. 6D, buried in the sand; January 10, 1947. Two small purple specimens.

Clypeaster humilis (Leske)

Figure 1

LOCALITIES: Station No. 6A, buried in the sand; January 10, 1947. Three specimens.

Station No. 6B, buried in the sand; January 10, 1947. Four specimens.

NOTE: Some of the specimens have the petaloid areas outlined in deep purple.

Metalia townsendi (Bell)

Figure 2

LOCALITIES: Station No. 7, buried in the sand; December 27, 1946. Two specimens.

Station No. 6A, buried in the sand; January 10, 1947. One broken specimen and fragments.

NOTES: All the specimens of this very delicate species were more or less broken when received. The best, from Station No. 7, was 68 mm. long, 60 mm. broad, and 36 mm. high.

FIG. 1. *Upper:* Station No. 7, February 4, 1947; *Clypeaster humilis*, buried. *Lower:* Same, with the *C. humilis* dug out. Photographs by Richard LeBaron Bowen, Jr.

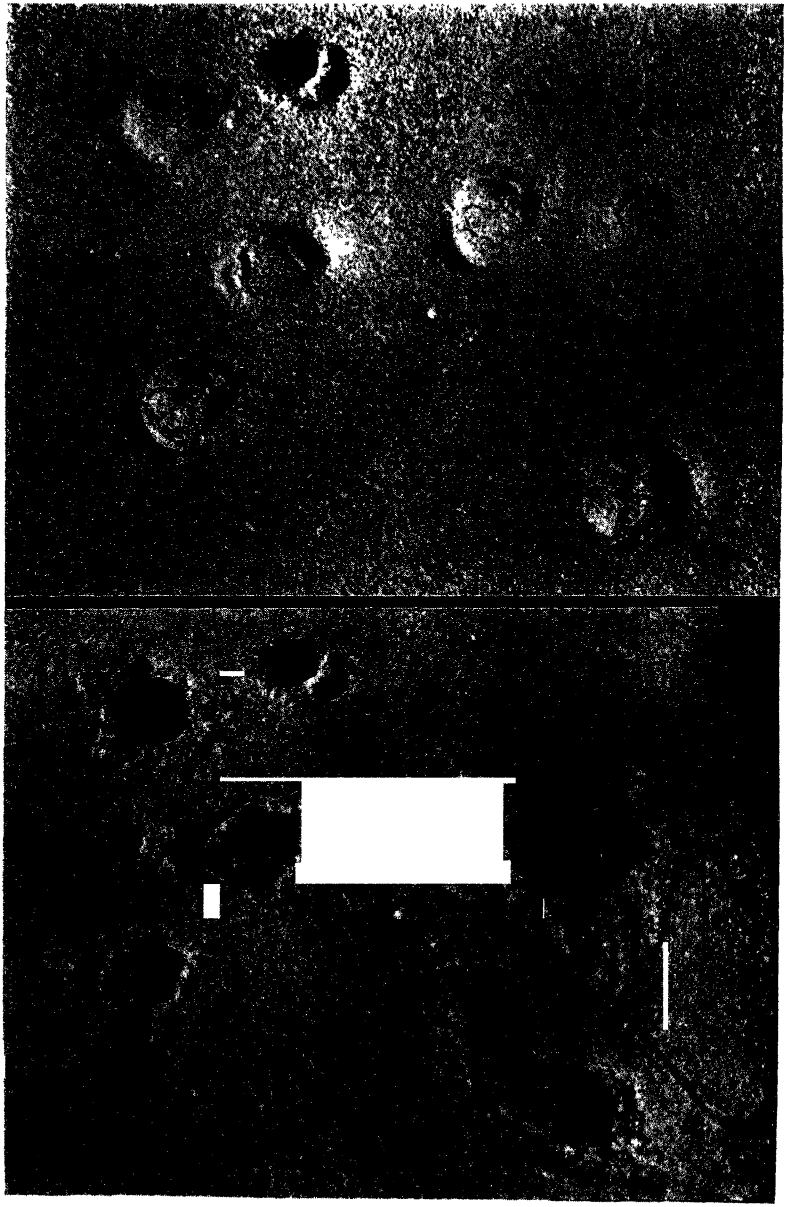

FIG. 2 *Upper:* Station No. 6C, January 10, 1947; doming bottom; six *Metalia townsendi*, buried; one *Lovenia elongata* emerging from the sand (upper left). *Lower:* Same, with the *M. townsendi* dug out. Photographs by Richard LeBaron Bowen, Jr.

Lovenia elongata (Gray)

Figure 2

LOCALITIES: Station No. 3, on top of sand; December 13, 1946. One specimen.

Station No. 7, buried in the sand; December 27, 1946. Two specimens.

NOTE: The two specimens from Station No. 7 are 72 and 52 mm. long.

NOTES BY RICHARD LEBARON BOWEN, JR.

RANGE

With the exception of the specimens collected on March 30, 1947, all the specimens came from the lower littoral fringes of the Persian Gulf and Tarut Bay. If it is assumed that the six-armed brittle-stars which were collected on May 30, 1947, are *Ophiactis savignyi*, the deep-water station produced only specimens found in the littoral fringe.

Early in the refinery construction program an arbitrary datum was selected on which to base all surveying. This datum was set at what was supposed to be Indian Spring High Tide; actually it was set a little low. The datum was defined as 0.00 feet; the refinery was built at +6.0 feet as finished grade. There were several tide boards set on this coordinate system with feet reading down to −7.0. There was a recording tide gauge at the West Pier. With this coördinate system at my disposal it was possible to estimate the relative elevation of any collecting station expressed as feet below the arbitrarily chosen datum.

From February 10, 1945, to August 30, 1947, the tides kept a characteristic seasonal pattern. In the summer the spring tide was about +1 foot, while the daylight spring low never went below −5 feet. The lowest tides were in January and February and reached a minimum of −7 feet in February. In February there would be two or three low tides 6 or 8 inches lower than any occurring in the rest of the year. The lowest tides on each side of these minima would probably be from −6 to −6.5 feet.

Looking back to the echinoderms as they occurred along the shores it appears that two starfishes (*Astropecten polyacanthus* and *A. pugnax*) and two sand dollars (*Echinodiscus auritus* and *Clypeaster humilis*) wander the highest, as they were found in sand bars as high as −5 feet. The upper range of the brittle-stars seems to have been about −6 feet, as was that of the starfish *Asterina cephea* var. *iranica*. The upper range of the heart urchins (*Metalia townsendi* and *Lovenia elongata*) was just about the same. *Echinometra mathaei* gave itself a safe margin against exposure to the air by living generally at from −8 to −10 feet. *Diadema* was found in this same range.

It is interesting to speculate on the maximum exposure these animals can stand without extermination. It should be noted that the brittle-stars, even though their actual station may be above the tide level, were generally in pools of water under rocks. The starfishes *Astropecten polyacanthus* and *A. pugnax* apparently stood the exposure of their sand bars well. Many of the *Clypeaster humilis* turned green even when buried. Exposure was fatal to *Lovenia elongata* as it came up out of the sand and never got more than a foot in its dash for water. One could not tell about *Metalia townsendi*, as this species was very inactive. *Echinometra mathaei* died quickly on exposure and became matted.

Occurrence

The number of specimens of each species that Mr. Clark received has no significance in the case of the starfishes and the sea-urchins, as only representative specimens were collected, and generally there were dozens of specimens of each to be had. But in the case of the brittle-stars the number of specimens that Mr. Clark received is of the utmost significance, as every one was collected that could be captured. *Ophiothrix savignyi* is by far the commonest brittle-star, as close to 100 specimens were collected; but the other five species turned up at isolated stations and were never found in numbers greater than six altogether.

When the marine fauna of the Persian Gulf at Ras Tanura is looked at as a whole, it is easily seen that the echinoderms form the most ubiquitous feature of the life in the lower littoral fringes in virtually every type of situation. Certainly they are predominant in sheer mass as well as in numbers. They appear to live in colonies, but it is more probable that a certain species is limited to certain types of situations and thus appears as colonial.

It is not easy to say just what the most frequently occurring echinoderm was, as it depended largely on the situation. But if one started out to see how many echinoderms one could collect from everywhere one would probably end up with *Echinometra mathaei* and *Ophiothrix savignyi* in largest numbers, with *Metalia townsendi*, *Echinodiscus auritus*, and *Clypeaster humilis* next in frequency. Of the other species, *Astropecten polyacanthus*, *A. pugnax*, *Asterina cephea* var. *iranica*, and *Lovenia elongata* would be common; but *Ophiothrix hirsuta*, *Amphilycus androphorus*, *Ophionereis dubia*, *Ophiactis savignyi*, *Ophiopezella fallax*, *Temnopleurus toreumaticus*, and *Diadema* would be rare. This may be an injustice to *Amphilycus androphorus* as not all *Metalia townsendi* or *Clypeaster humilis* were examined for this brittle-star; its occurrence may well be common.

Several times before leaving Arabia I returned to the localities where the needle-urchin (*Diadema*, sp.) was first seen on May 25, 1945, and attempted to collect specimens of this urchin, but they were nowhere to be found. It seemed strange that they should be present in such numbers at first and then later totally absent. The sulphurous waste and gasoline that has been allowed to escape into Tarut Bay about 3 miles north of Station No. 3 since the refinery started in October, 1945, may have driven these fast-moving urchins away. *Echinometra mathaei* was still present in the same quantities as before.

GEOGRAPHICAL RANGE

One will notice that virtually all the stations listed are in Tarut Bay, but this by no means should imply that no collecting was done on the Persian Gulf side of the Ras Tanura Peninsula. Probably as many trips were made on the Persian Gulf side as were made on Tarut Bay, wherein mollusks and other animals were collected. With the exception of the six-armed brittle-stars [presumably *Ophiactis savignyi*--A.H.C.] found on May 30, 1947, the only echinoderm that was found in the littoral fringe of the Persian Gulf was *Echinometra mathaei*. This urchin was living either on the rocks or in little caves in the soft rock, from which it was impossible to remove it without breaking the rock. In general *Echinometra mathaei* tended to be ensconced in rock caves on the Persian Gulf side, while in Tarut Bay *E. mathaei* was simply found walking on top of rocks and on the bottom. This urchin was never seen in a rock cave in Tarut Bay.

Strong north winds (known as *shamal* to the Arabs) blow frequently in Arabia and produce relatively strong wave action along the whole Arabian coast. Tarut Bay, in vivid contrast, is always sheltered, so that the wave action along the Ras Tanura shores is practically negligible. There were dozens of stations on the Persian Gulf that were identical in appearance with those in Tarut Bay, but none of the echinoderms that were common in Tarut Bay were found on the Persian Gulf. Presumably the stronger wave action along the shore has limited the animals to deeper water on the Persian Gulf side.

SUMMARY OF DATA OF OCCURRENCE

	Occurrence	Upper Range	Typical Station
ASTEROIDEA			
Astropecten polyacanthus	Common	−5 feet	Buried in sand bars
Astropecten pugnax	Common	−5 feet	Buried in sand bars
Asterina cephea	Common	−6 feet	On under side of rocks
OPHIUROIDEA			
Ophiothrix hirsuta	Rare	−6 feet	Underneath rocks
Ophiothrix savignyi	Extremely common	−6 feet	On under side of rocks and underneath rocks
Amphilycus androphorus	? Common	−6 feet	On heart urchins and sand dollars
Ophionereis dubia	Rare	−6 feet	On under side of rocks and underneath rocks
Ophiactis savignyi	Rare	? − 7 feet	In porous rocks
Ophiopezella fallax	Rare	− 6 feet	Underneath rocks
ECHINOIDEA			
Echinometra mathaei	Extremely common	−8 feet	On rocky bottom, many times near coral growth
Temnopleurus toreumaticus	Rare	−6 feet	Buried in the sandy bottom
Echinodiscus auritus	Very common	−5 feet	Buried in sand bars and in sandy bottoms
Clypeaster humilis	Very common	−5 feet	Buried in sand bars and in sandy bottoms
Metalia townsendi	Very common	−6 feet	Buried in the sandy bottom
Lovenia elongata	Common	−6 feet	Buried in the sandy bottom
Diadema, sp.	? Rare	−9 feet	On rocky bottom near coral

FIELD NOTES

TARUT BAY, STATION NO. 3, MAY 25, 1945: Station No. 3 is a point jutting into Tarut Bay. In the muddy area below the plunge point (between the end of the coral reef and the fish trap on the north side of the point) there were dozens of *Echinodiscus auritus* plowing along and leaving their characteristic mark just under the surface at elevation −6 and −7 feet. In going from the sandy beach to deeper water on the north side of this point I started running into brain corals. They were circular and about the size of very small melons. This was in about 3 feet of water at low tide.

I approached a dark spot some distance away in the water, and there was a small mound under water made up of branching, treelike coral and brain coral. All over this mound was *Echinometra mathaei*. Most of the individuals were crawling over it, but a few were in niches, apparently settled down. On one side of the mound, the top of which was 2 to 3 feet under water, was an echinoderm of a type I had never seen before. This needle-urchin (*Diadema*, sp.) had tremendously long spines about a foot long. The test was circular. I left it there, as I had nothing with which to lift it out and it appeared rather formidable. This mound was between a fish trap and the Ras Tanura Peninsula. There seemed to be three species of brain coral.

All around was *Echinometra mathaei*, walking on the mud-covered bottom, with bits of shells, corals, and other urchins on top of their spines. Some had one small piece covering perhaps 5 to 10 per cent of their outline, and one had six pieces covering maybe 30 to 40 per cent of its outline. It certainly was not very effective as a camouflage, as it seemed to "spotlight" them, where their dark form might well go unnoticed in the coral on the mud flats.

Farther down towards the end of the point a band of coral runs parallel to the shore on the north and forms a dark band in the water when seen from the shore. Here all the species of corals are stacked up with huge brain corals perhaps 2 feet in diameter. Here I picked up a needle-urchin (*Diadema*, sp.) with a stick. It had what looked like a purple anemone sticking out of the top of the test. The spines have thousands of barbs on them. If you are holding a spine and let it slip through your fingers the barbs break off and impart a purple color to your skin for days. When anything approached these needle-urchins, they waved all the spines through a distance of perhaps half an inch to an inch in the area from which the disturbance came.

Just on the other side (south side) of the point a strange change takes place. There is also a coral band just off shore with the same types of coral, but there is a relative lack of *Echinometra mathaei*. *Diadema* is predominant and common here. As I walked across the sand spit which juts out from the point to the west and was just under water, I noticed that the north side was level with the spit, but the south side dropped off rapidly. At the shallowest point the water was very cool from evaporation.

The needle-urchins were not on the coral here as the average *Echinometra mathaei* were; they were on the mud-covered rock bottom between the coral and the shore. These urchins seemed to be in clusters of from three to eight with the spines almost touching. Occasionally there were stray single needle-urchins and *Echinometra mathaei*. On the north side I observed only two needle-urchins, but there were hundreds of *Echinometra mathaei*, mostly on the coral. The needle-urchins on the south were nowhere near as plentiful as was *Echinometra mathaei* on the north. As the top of the coral at Station No. 3 is just under water at the lowest tides, this would make the elevation about 3 feet below (as an average) for these urchins, or about −10 feet.

So far, I have noticed that sea-urchins and coral seem to go together. On the Persian Gulf side of the peninsula there were some brain corals in small bits on the rocks in which I found three *Echinometra mathaei* some time ago ensconced in holes in the soft limestone rock.

TARUT BAY, STATION NO. 3, DECEMBER 13, 1946: In a sandy lagoon at about elevation −6.4 feet I found a *Lovenia elongata* moving rapidly on the top of the sand in 6 inches of water. The lowest tides would drain this lagoon.

TARUT BAY, STATION NO. 7, DECEMBER 23, 1946: At Station No. 7 at low tide I found two interesting urchins, *Temnopleurus toreumaticus*. Station No. 7 was a long sand bar rising out of the semisandy surroundings about a foot and a half, with a top elevation of −5.3 feet. These urchins were buried under about 1 inch of sand at about elevation −6 feet. They were perfectly circular, 36 and 28 mm. in diameter, or, counting the spines, 55 and 40 mm. The spines were dark purple with half a dozen or so wide white bands. The test underneath was a light whitish color. These two were the only ones I have ever found in shallow water. I have seen native divers bring up similar specimens in 30 feet of water about a mile away.

[Speaking of the eastern side of the Gulf, Dr. Th. Mortensen says that "This species appears to be the commonest Echinoid, outside the reefs, and seems to be common all over, on clay or sand bottom. Most of the specimens are quite small, and of very light colour. In the ecology of the sea it must evidently play a considerable rôle." Specimens from the Persian Gulf are almost all small and light colored. Dr. H. L. Clark wrote that a fine series which the Museum of Comparative Zoölogy received from Capt. F. W. Townsend in 1895 had the ground color very light, usually a pale cream color, in some with a more or less marked olive green cast, and primary spines very conspicuously banded with brownish or purplish red. He said that these specimens appear to be identical with those from the Arabian coast of the Red Sea described by Koehler as a new species, *Temnopleurus perezi.* But both he and Mortensen point out that there seems to be no reliable difference between *perezi* and typical *toreumaticus*. Mortensen found in Dr. H. Blegvad's collection from the east side of the Persian Gulf a specimen with the spines much darker colored, and furthermore he has seen light-colored specimens from India, Singapore, and Indo-China. He says it seems that such light-colored individuals are those living on a white sandy bottom, whereas those that live on a grass bottom are much darker in color. The maximum size of this species in the Persian Gulf and Red Sea appears to be about 40 mm. in diameter. Elsewhere it reaches a diameter of 51–53 mm.—A.H.C.]

TARUT BAY, STATION NO. 7, DECEMBER 27, 1946: While looking for giant olive shells in the sandy bottom off of Station No. 7, I played with a number of *Metalia townsendi* whose presence could be detected by little cone-shaped hollows in the sand with a movement of sand particles at the bottom, where the animal was apparently dredging its way through the sand. The bottom was made up of coarse sand with a little muddy substance to it. The elevation was probably −7 to −8 feet. Low tide reached −6 feet today.

At virtually every step you could feel the crunch of a test collapsing like an egg shell. When a *Metalia townsendi* is uncovered it shows little if any detectable action, but a *Lovenia elongata* immediately starts to burrow again if uncovered. So active are the spines on these latter urchins that it is difficult to pick them up; I did succeed in pricking myself with one in water up to my armpits.

I turned up two *Metalia townsendi* which seemed to be different from the average. One was about 17 mm. long; the other was about 32 mm. long. It must be the juvenile state that makes the proportions of these urchins different from the adults.

Looking back on the specimen of *Lovenia elongata* found on December 13, 1946, it is difficult to understand why it was not buried.

TARUT BAY, STATION NO. 6A, JANUARY 10, 1947: This station was a sand bar jutting out from one wing of a fish trap about one-quarter of a mile from shore. The top of the bar is about −5.3 feet. It dropped off gradually all around until it reached the bottom 2 feet farther down all around. Today low tide reached −6.4 feet.

All over the bar were *Clypeaster humilis*. These were about 3 feet apart in any direction. Some had already started turning green from exposure to the air, although still buried in the sand. These were large ones, on the average about 4 inches in diameter, possessing a brown color when alive. I found only one large *Echinodiscus auritus* about 4 inches long. It was a characteristic dark purple color.

I found a few *Metalia townsendi*—maybe 10. These have a pinkish reddish tan color, with short stubby spines. I also found a few *Lovenia elongata*—maybe five. All had plowed up to the surface of the sand and some had traveled 6 inches or a foot. The *Metalia townsendi* were all buried.

I found a few *Astropecten polyacanthus* buried in the sand. They have a gray back with black dots and white spines sticking out and up. I also found a few *Astropecten pugnax*. These have a purplish top with a sort of reptilian pattern. These were likewise buried in the sand.

Later in the bottom of the look-box in which I had several *Metalia townsendi* I found an *Amphilycus androphorus*. I had noticed small brittle-stars living on *Metalia townsendi* on these bars before.

TARUT BAY, STATION NO. 6B, JANUARY 10, 1947: There are tens of big and little *Clypeaster humilis* here, but not an *Echinodiscus auritus* or other urchin evident. Station No. 6B was a bar 5 feet wide and 100 feet long with an elevation of −6.2 feet.

TARUT BAY, STATION NO. 6C, JANUARY 10, 1947: While I was on the last bar it started to go under, so I hurried to the next inshore sand bar, Station No. 6C. This turned out to be a part of the bottom gently doming up out of the water, with a maximum elevation of about −6.0 feet. It was composed of muddy coarse sand with lumps of coral. About every 8 inches or a foot over the whole area, which was perhaps 50 feet in diameter, was the mark of a *Metalia townsendi* moving under the surface. A few were attempting to reach water. Perhaps one out of every 20 heart urchins was a *Lovenia elongata*, which had pushed out and started crawling somewhere (see fig. 2). Many times it got no farther than just breaking out of the sand. There were also a few *Clypeaster humilis*, generally large. This is a part of the same bottom described on December 27, 1946, off Station No. 7.

TARUT BAY, STATION NO. 6D, JANUARY 10, 1947: As the tide continued in I hurried to a last sandy bar, Station No. 6D, about 2 feet wide and perhaps 30 feet long. I found two of the smallest *Echinodiscus auritus* ever found, and also a few small *Clypeaster humilis*.

In the bottom of a jar of alcohol in which I had put these two very small *Echinodiscus auritus*, a few small *Clypeaster humilis*, and numerous mollusks I found an *Amphilycus androphorus*. It has a star pattern on its body [probably the attached male—A.H.C.]. It must have come from one of the *Clypeaster humilis*, as the two *Echinodiscus auritus* were so small and had such smooth surfaces that I would have noticed a brittle-star on them when I picked them up.

TARUT BAY, STATION NO. 7, FEBRUARY 4, 1947: There were a couple of cracks in the sand at about elevation −6.1 feet. When I dug these out I found a large *Clypeaster humilis* and several mollusks (fig. 1).

TARUT BAY, STATION NO. 5, FEBRUARY 6, 1947: We decided to take a quick run down to the Terminal to look at the tide at noon. To our amazement whole areas that we had never seen before were out. We stopped at a likely cowry station, probably about elevation −6.5 to −6.9 feet. The ground here consisted of flat rock ledges with porous rocks scattered at intervals. I found only three *Ophiothrix savignyi* under these rocks. Also under these rocks were individuals of *Asterina cephea* var. *iranica*, with mottled brown and red surfaces. These starfishes have a habit of absolutely assuming the contour of the rocks as if they were glued to them. They even get themselves into small holes and almost turn themselves inside out in doing so. They are always found under rocks, clinging to the under side.

TARUT BAY, STATION NO. 4, FEBRUARY 7, 1947: I got down on the spit before low tide and found the same conditions as prevailed yesterday. I started on a rock ledge laid bare on the south side of Station No. 3, which was 4 inches out of water at elevation −6.5 feet. On the outside was the coral reef, a band about 20 feet wide on the edge of the dropoff. The tops of the branched corals were just under water.

Under porous rocks in little pools on the rock ledge I found 16 *Ophiothrix savignyi*. I studied these 16 brittle-stars for a long time and could not detect two of the same color or appearance. I also found two *Ophiothrix hirsuta* in pools under these same rocks. One was small, 3 inches in diameter; the other large, 12 inches in diameter.

On the under side of these rocks I found two baby *Echinometra mathaei*. The spines on one of these, 40 mm. in diameter, appeared proportionately longer than those in the fully grown ones, or on the smallest one, 15 mm. in diameter. The spines on neither of these matted as they do on the adult individuals. This must be characteristic of the young specimens.

TARUT BAY, STATION NO. 2, FEBRUARY 21, 1947: I went to Zaal Island today. The minimum water was −6.5 feet. We picked our way in through sand bars until we were in as far as we could go in the launch. We were face to face with a reef running parallel to the shore and indicating the start of a place where one could walk ashore. There were large flat rocks strung along, making a cliff. Covering this reef were hundreds of *Echinometra mathaei*, in a band 2 to 3 feet wide, running along the edge at a depth of from $1^1/_2$ to 2 feet below lowest water (elevation −8 to −8.5 feet). Among the rocks were scattered leafy weeds; no other forms of life could be detected among the urchins.

Farther in on a sand bar at an elevation of from −5 to −6 feet were two large *Echinodiscus auritus* and one large *Clypeaster humilis*. At elevation −5.5 feet several medium-sized *Echinometra mathaei* were found under rocks. These certainly had wandered far above their range.

The most prominent feature of the whole of the deeper water ground (now exposed) was the presence of brittle-stars. They ranged from elevation −6 feet down into the water, always under flat and porous rocks in pools of water. There were but few rocks here the under side of which did not yield at least a couple of brittle-stars. One must move fast or they slide into a hole or under a rock. Generally they were attached to the bottom of the rocks, but sometimes they were in the water. They have an uncanny habit of sliding into the smallest hole of any kind. It is annoying to see how an animal with no sense of sight can pick a hole and disappear so quickly. Perhaps they do have a sensitivity to light. The moment a tip of an arm finds a shady spot, after they have been exposed to light, the rest of the animal quickly slides into it. This was true of a can I had them in, as they were always crowded in the shady edge.

I found two *Ophiothrix hirsuta.* Their arms were about 15 and 8 inches long, the animals being 30 and 16 inches in diameter. I put them in fresh water for 24 hours, then in alcohol for 24 hours, and then dried them, as I did all the other brittle-stars. I found four *Ophiopezella fallax.* These were always in the water under the rocks, never on the rocks themselves as was *Ophiothrix savignyi. Ophiopezella fallax* has tan and brown banded arms and a tan pentagonal body. The bands do not always stop on even plates, the average being three plates to a color. In fresh water they emitted a brown fluid from their mouths which discolored the body slightly. They have eight short stubs of spines at each plate junction on each side. The bands do not go all the way around the arms, as the under side is white.

I found five *Ophionereis dubia.* These have long thin arms with short spines and a circular smooth body. Although they look white, they have a decidedly green cast under a glass. I also found about 48 *Ophiothrix savignyi.* A study with a glass could not produce two alike so far as color and structure went.

Also under these rocks I found occasionally—perhaps 10 or 15 all told—*Asterina cephea* var. *iranica.* These have little protruding papulae all over their backs. One looks fatter than the others. They all have a greenish color with a little red in some cases.

Tarut Bay, Station No. 1, March 7, 1947: On the bottom of flat rocks resting on rock ledges at elevation −6 to −6.5 feet I found six *Ophiothrix savignyi* and one *Ophiopezella fallax,* which was gray (whereas the ones from Station No. 2 were tan). The gray was immediately noticeable.

PERSIAN GULF, STATION NO. 8, MARCH 30, 1947: The Marine Department raised a buoy and anchor that had been in 40 feet of water by the submarine loading lines off the East Pier on the Persian Gulf side of the Ras Tanura Peninsula for six years. I collected specimens from the concrete anchor block that was on the bottom and from a buoy that floated halfway up at 20 feet. I collected 20 *Ophiothrix savignyi* and one small *Ophiactis savignyi*.

TARUT BAY, STATION NO. 5, APRIL 19, 1947: The wind of the present *shamal* was blowing in its second day. That the tide would be exceptionally low today could be guessed at 8:30 A.M. from the height of the water then, for even then it was low. It hit a low of −6.5 feet at 11:30 A.M., about 1 foot lower than would be expected. I stopped by a spot where there were rocks out in the water where old fish traps had been. The rocks were of the porous sea rock type with a hollow spongy structure, resting on a sandy bottom at elevation −6.5 to −7.0 feet. I found four *Ophiothrix savignyi* here.

TARUT BAY, STATION NO. 5, APRIL 20, 1947: I went to the same station as yesterday, but the tide did not get so low. This time I covered deeper rocks which I missed yesterday. They were all in from 3 to 12 inches of water, so some specimens could have escaped in picking up the rocks. I found only one *Ophiothrix savignyi* at an elevation of from −7.0 to −7.5 feet.

PERSIAN GULF, STATION NO. 9, MAY 30, 1947: I collected a lot of rocks for forms of life other than echinoderms from an elevation of from −6 to −10 feet and kept them in stale water. From the bottom of the pail I collected a lot of little six-armed brittle-stars [presumably *Ophiactis savignyi*—A.H.C.].

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SYMPATRIC SPECIES OF *CALISTO* IN CUBA (LEPIDOPTERA, SATYRINAE)

BY CHARLES D. MICHENER

The butterfly genus *Calisto* consists of about 19 species, several of them with described subspecies, and all from the Greater Antilles and the Bahamas. As indicated in a review of the genus (Michener, 1943) and subsequent papers (Clench, 1943, 1943a), 13 of the species are confined to Hispaniola, one to Puerto Rico, and one to Jamaica. The remaining group, consisting of very closely related forms, occurs in Cuba and the Bahamas, there being in Cuba five named populations, to which a sixth is added in this paper.

One form, *Calisto herophile herophile* Hübner, occurs apparently throughout Cuba and in the Isle of Pines. Dr. S. C. Bruner of the Estación Experimental Agronómica, Santiago de las Vegas, writes that so far as he remembers *herophile* has been found in every suitable location visited, except perhaps above 4000 feet. It does not occur in deep forest, but is found in more or less shady spots around fields, along roadsides, and the like. *Calisto herophile parsonsi* Clench and *C. smintheus muripetens* Bates were described from the Trinidad Mountains of southern central Cuba. Nothing has been recorded of the sort of environment in which they occur.

In the province of Oriente no fewer than three additional forms of *Calisto* occur, each apparently in a limited area. Two of them are known to occur with the widespread *C. herophile*, while the third probably does so. They are extremely closely related to *C. herophile*. *C. smintheus smintheus* Bates was collected in the Sierra del Cobre between 2750 and 3325 feet altitude. Here, unlike *herophile*, it occurs in the deep woods, so that there is evidently relatively little mixture with the population of

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[illegible] Agricultural Research Institute

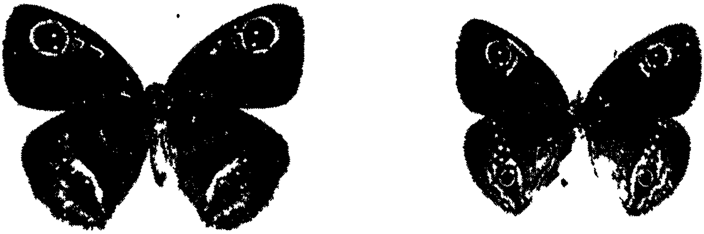

FIG. 1. Left, under surface of allotype of *Calisto bruneri* Michener Right, under surface of *Calisto herophile* Hübner, from Santiago de las Vegas, Cuba.

herophile which occurs in the same general region. *C. delos* Bates, which might well be considered a subspecies of *smintheus*, occurs on Pico Turquino, between 4000 and 6000 feet altitude, less than 70 miles from the Sierra del Cobre.

The third form, morphologically more different from *herophile* than are *smintheus* and *delos* but in appearance more similar to *herophile*, has recently been sent to me by Dr. Bruner. It was collected at sea level at Moa, on the north coast of Oriente, where it occurred with *C. herophile* but was somewhat less abundant than that species. This new species is named *C. bruneri*.

It is evident that reproductive isolation exists between the geographically restricted *Calisto* populations of Oriente and the widespread *C. herophile* population. As has been recently emphasized (Mayr, 1947), it is unlikely that reproductive isolation can arise between contiguous populations. It is therefore probable that such isolation arose when the populations were geographically isolated from *C. herophile*.

How they were isolated from *herophile* is not evident. Possibly *C. herophile*, like the others, was limited in distribution at one time, permitting geographical isolation, and only recently, perhaps as a result of deforestation by man, spread to occupy the whole of Cuba. Possibly *C. bruneri* arose on an outlying island or even on one of the Bahamas which lie near the northeast coast of Cuba, and only later reached Cuba.

Calisto bruneri, new species

This species is very similar to the common and well-known *C. herophile* Hübner, from which it differs as follows: Size on the average larger; coloration, especially beneath, darker. Red

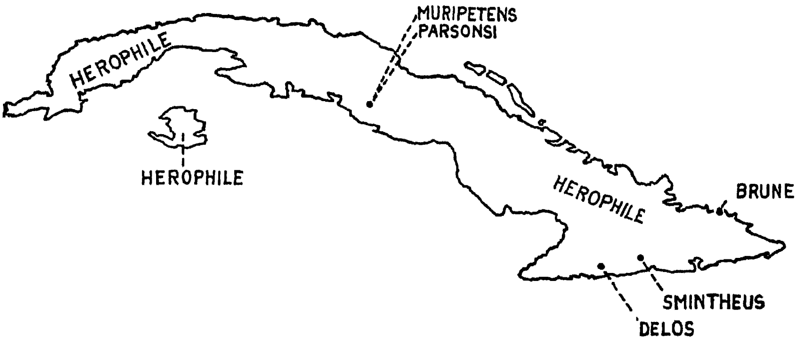

FIG. 2. Map of Cuba showing the distribution of the Cuban forms of *Calisto*.

area on under surface of forewing longer than in *herophile*, often as long as broad and sometimes longer than broad; dark line which limits outer margin of red area usually angulate medially. White dot in oval eye spot of under surface of hind wing usually inserted in line with yellowish margin of eye spot, this margin often extending towards wing base to form a short lobe enclosing white dot; white dots usually absent in cells R_3 and M_1. Uncus of male longer and more slender than in either *C. herophile* or *C. sminthcus*, being over 1.5 times as long as ninth tergum; distal portion of harpe more slender and shorter than in related species.

TYPE MATERIAL: Holotype male, allotype female, and five paratypes from Moa, Oriente, Cuba, February 24 to 27, 1948 (F. de Zayas and J. Ferrás). One additional paratype from the same locality, April 13 to 22, 1945 (J. Acuña). Two paratypes have been returned to Dr. Bruner and one has been sent to the Museum of Comparative Zoölogy. The rest of the type material is in the American Museum of Natural History.

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ON THE IDENTITY OF *ODONTOTERMES* (ISOPTERA, TERMITIDAE)

BY MUZAFFER AHMAD[1]

Odontotermes was erected by Holmgren in 1910 with *O. vulgaris* (Haviland) as the generitype (type locality: Natal, Africa). It is a large genus comprising three subgenera, *Odontotermes* Holmgren, *sensu stricto*, *Hypotermes* Holmgren (1912a), and *Euscaiotermes* Silvestri (Silvestri, 1923). It includes about half of the fungus-growing termites belonging to the subfamily Macrotermitinae. Some of the species belonging to *Odontotermes* were formerly included by Holmgren (1912a) in another subgenus, *Cyclotermes*. *Hypotermes* [generitype: *Odontotermes* (*H.*) *xenotermitis* (Wasmann) from Burma] and *Euscaiotermes* [generitype: *Odontotermes* (*E.*) *primus* Silvestri from Chilka Lake, India] are easily distinguishable from *Odontotermes*, but *Cyclotermes* [generitype: *Odontotermes* (*O.*) *obesus* (Rambur) from Bombay, India] presents great difficulty in separating its species from those of *Odontotermes*. A detailed study, based upon the material in the collection of the American Museum of Natural History now in the hands of Dr. Alfred E. Emerson, has been made of the exact status of *Cyclotermes*.

The present work was done under the guidance of Dr. Emerson to whom the author wishes to express his great indebtedness.

Holmgren (1912a) distinguished *Cyclotermes* from *Odontotermes* on the basis of the following characters:

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[1] Department of Zoology, the University of Chicago.

Cyclotermes	*Odontotermes*
Imago: Postclypeus half as long as wide	Postclypeus not half as long as wide
Soldier: Left mandible with forwardly pointing tooth. Mandibles relatively small, delicate, and saber shaped. Head distinctly narrower in front	Left mandibles with a stout but not forwardly pointing tooth in different positions. Mandibles short and thick. Head usually rectangular
Small species	Mostly large species

The above characters were studied thoroughly and subjected to statistical analysis wherever necessary.

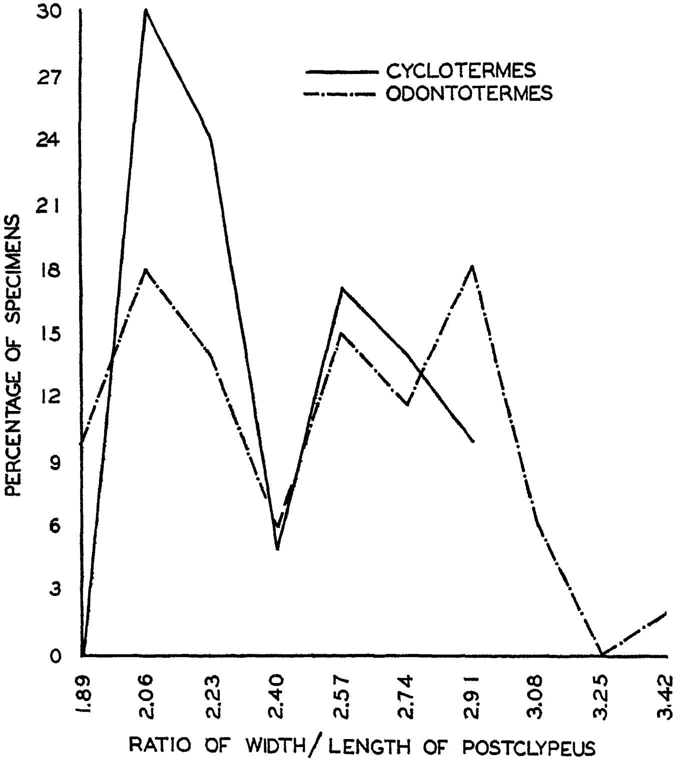


Fig. 1. Frequency distribution of the ratio of width to length of the postclypeus of imago.

Imago: This caste has been separated on one main character only, the relative size of the postclypeus. In order to analyze this character the width and the length of the postclypeus of the species of *Odontotermes* and of those formerly included in *Cyclotermes* were measured and their ratios computed (fig. 1, table 1).

TABLE 1

Ratio of Width to Length of Postclypeus of Imago

Name of Species	Range	Number	Mean
Species included in the subgenus *Odontotermes:*			
O. badius (Haviland)	2.88–2.91	2	2.89
O. buchholzi (Sjöstedt)	2.65	1	
O. angustatus (Rambur)	2.08–2.60	8	2.37
O. classicus (Sjostedt)	1.83	2	1.83
O. assmuthi Holmgren	2.44	1	
O. feae (Wasmann)	2.19	1	
O. bogoriensis (Kemner)	1.83	1	
O. ceylonicus (Wasmann)	1.89–2.55	5	2.09
O. horni (Wasmann)	2.00–2.02	4	2.00
O. grandiceps Holmgren	2.57	1	
O. javanicus Holmgren	2.84	1	
O. indrapurensis Holmgren	2.75	1	
O. sundaicus Kemner	2.54	1	
O. taprobanes (Walker)	1.72	1	
O. malabaricus Holmgren	2.00	1	
O. latialatus (Sjöstedt)	2.47	1	
O. ostentans (Silvestri)	2.00–2.50	5	2.26
O. pauperans (Silvestri)	2.55–3.00	7	2.79
O. palmquisti (Sjöstedt)	2.72	1	
O. planiceps (Sjöstedt)	1.77	1	
O. scrutor (Sjöstedt)	2.87	1	
O. schmitzi (Emerson)	2.75–3.42	6	2.95
O. smeathmani (Fuller)	2.00–2.08	2	2.04
O. trägårdhi Holmgren	2.40	1	
O. vulgaris (Haviland)	2.20	2	2.20
Species formerly included in the subgenus *Cyclotermes:*			
O. orissae (Snyder)	1.95–1.97	2	1.96
O. flavomaculatus Holmgren	1.92	1	
O. lathericius (Haviland)	1.96	1	
O. formosanus (Shiraki)	2.30–2.81	12	2.61
O. erodens (Sjöstedt)	2.00	1	
O. aquaticus (Sjostedt)	1.91–2.44	2	2.17
O. preliminaris (Holmgren)	2.50	2	2.50
O. distans Holmgren	2.16–2.33	2	2.24
O. redemanni (Wasmann)	2.00–2.43	4	2.11
O. bangalorensis Holmgren	2 15–2.20	2	2.17
O. assamensis Holmgren	2.09	1	
O. bellahuniensis Holmgren	2.75	1	
O. almorensis (Snyder)	1.94–2.08	3	2.01
O. obesus (Rambur)	2.00–2.50	8	2.16

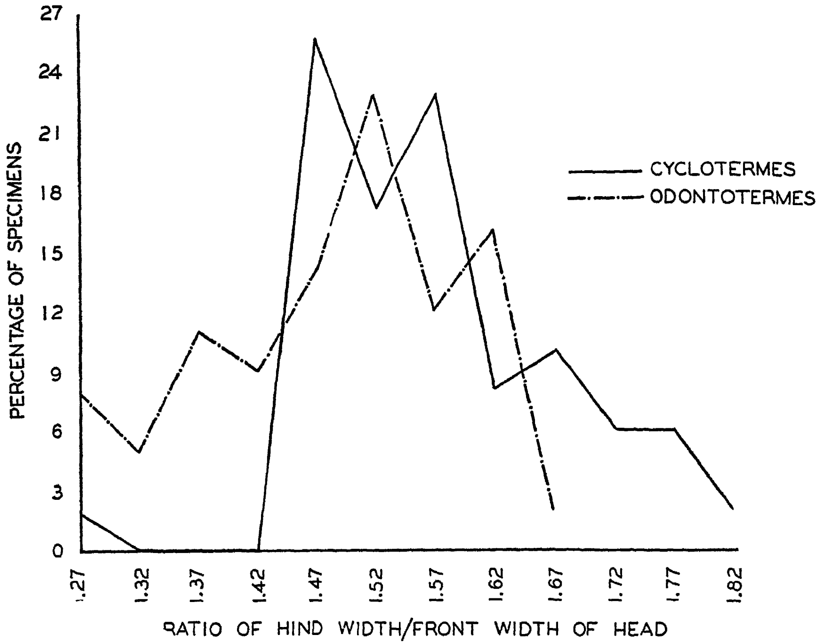
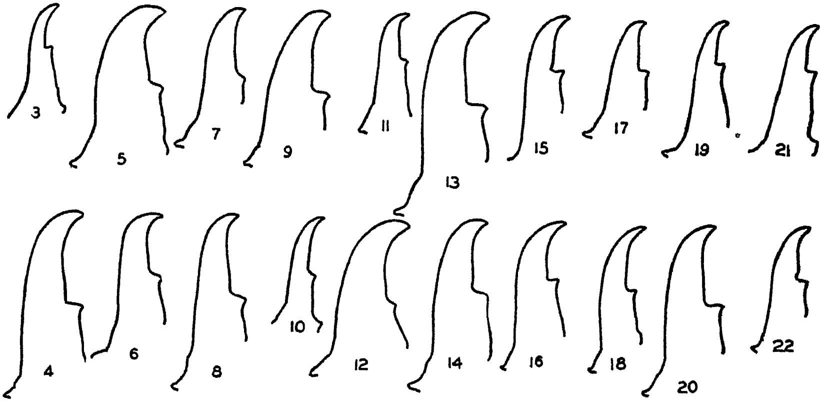


FIG. 2. Frequency distribution of the ratio of hind width to front width of the head of soldier.

A glance at the figure shows almost a complete overlap between the two graphs, and consequently *Odontotermes*, *sensu stricto*, and *Cyclotermes* are not distinguishable. One striking point, however, is that both the graphs indicate bimodality. If the two categories on either side of W/L ratio of 2.40 are lumped together and their frequency distribution is determined they might be considered to be two distinct entities. This would involve a transfer of some species formerly included in *Cyclotermes* to *Odontotermes* and *vice versa*. Thus all the specimens showing W/L ratio 2.40 or less might be regarded as *Cyclotermes* and the rest above 2.40 as *Odontotermes* according to definition. The possibility exists that there might have been some former misidentifications which could be corrected by this means. That this is not true will become evident by taking a few examples. *Odontotermes (O.) bogoriensis* with a W/L ratio of 1.83 would be classified under *Cyclotermes* according to this scheme, but if we look at the mandibles of its soldier caste (fig. 42) we find that it is an *Odontotermes* type (according to Holmgren's description of *Odontotermes*). *O.*



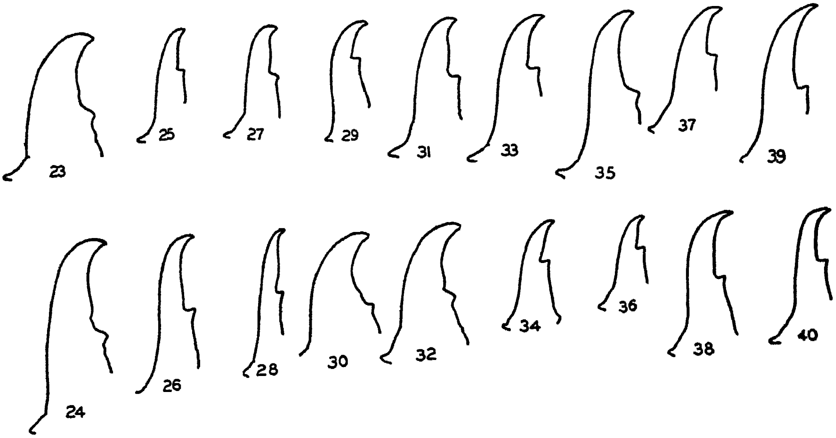
FIGS. 3–22. Left mandibles of *Odontotermes*. 3. *angustatus*. 4. *badius*, major soldier. 5. *badius*, minor soldier. 6. *amanicus*. 7. *anceps*. 8. *bequaerti*. 9. *culturarum*. 10. *classicus*. 11. *fulleri*. 12. *fidens*. 13. *monodon*. 14. *kibarensis*. 15. *malelaensis*. 16. *mukimbunginis* Sjostedt. 17. *nolaensis*. 18. *ostentans*. 19. *nilensis*. 20. *patruus*. 21. *planiceps*. 22. *pauperans*.

horni with an average ratio of 2.00 might also be classified under *Cyclotermes*, but if one examines its soldier mandibles (fig. 44) one would identify it as a species of *Odontotermes*. *O. formosanus* with an average W/L ratio of 2.61 was formerly included in *Cyclotermes*. Moreover the variation within a species (e.g., *O. angustatus* with a range of 2.08–2.60) is so great that it is not possible to use this character in subgeneric identification.

Thus it follows that if Holmgren's classification is adopted the same species would be put under *Odontotermes* or *Cyclotermes* depending upon what caste is examined. Holmgren (1912b) himself does not seem to be very clear about the correct identity of this group. In his monograph of the oriental termites he includes *O. ceylonicus*, *O. horni*, and *O. feae* under category A of his key to *Odontotermes* species which he defines as including species with "postclypeus quite strongly arched, as long as half its width or only a little shorter . . . . " These are the characters of *Cyclotermes* as given in his earlier paper (1912a).

A list of the species with localities of *Odontotermes* whose imagoes are known but not included in the present study follows:

Ethiopian species:
agilis (Sjostedt), Liberia
angustipennis (Sjostedt), Belgian Congo



FIGS. 23–40. Left mandibles of *Odontotermes*. 23. *stanleyvillensis* (Emerson). 24. *schmitzi*. 25. *scrutor*. 26. *somaliensis* (Sjöstedt). 27. *stercorivorus* (Sjöstedt). 28. *sjöstedti* (Emerson). 29. *snyderi* (Emerson). 30. *robustus* Sjöstedt. 31. *sudanensis* Sjöstedt. 32. *rectanguloides* Sjöstedt. 33. *transvaalensis*. 34. *vulgaris*. 35. *trägårdhi*. 36. *assmuthi*. 37. *bitteli*. 38. *ceylonicus*. 39. *dives*. 40. *anamallensis*.

apollo (Sjöstedt), British East Africa
aurora (Sjöstedt), Zanzibar
bottegoanus (Sjöstedt), northeast Africa
caffrariae (Sjöstedt), Natal
capensis (DeGeer), Kapland
culturarum Sjöstedt, Tanganyika
diana (Sjöstedt), Belgian Congo
ebeni (Sjöstedt), Abyssinia
egregius Sjöstedt, British East Africa
fidens (Sjöstedt), Gold Coast
interveniens Sjöstedt, Belgian Congo
iratus (Sjöstedt), Gabun
kibarensis (Fuller), Uganda
lautus (Sjöstedt), Transvaal
microps (Sjöstedt), Tanganyika
nilensis[1] Emerson (MS), Sudan
nolaënsis Sjöstedt, Cameroon
ramulosus (Sjöstedt), German East Africa
rehobothensis (Sjöstedt), German South West Africa
rothschildianus (Sjöstedt), Abyssinia
salebrifrons (Sjöstedt), northeast Africa
silvestrii Sjöstredt, Kongo
terricola (Sjöstedt), Cameroon
transvaalensis (Sjöstedt), Transvaal

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[1] The credit for authorship of this species should be given to Emerson.

Oriental species:
- *brunneus* (Hagen), India
- *dehraduni* (Snyder), India
- *dives* (Hagen), Philippines
- *hageni* Holmgren, Borneo
- *holmgreni*[1] Snyder and Emerson (MS), Celebes
- *incisus* Holmgren, Sumatra
- *koenigi* (Desneux), Ceylon
- *latissimus* (Kemner), Sumatra
- *makassarensis* Kemner, Celebes
- *proximus* Holmgren, Malacca
- *wallonensis* (Wasmann), India

SOLDIER: As in the case of the postclypeus of the imago, the width of head in front and behind was measured and the ratios of these widths were obtained (fig. 2, table 2).

TABLE 2

RATIO OF HIND WIDTH TO FRONT WIDTH OF SOLDIER HEAD

Name of Species	Range	Number	Mean
Species included in the subgenus *Odontotermes:*			
O. assmuthi	1.35–1.44	4	1.40
O. feae	1.52–1.67	4	1.59
O. bogoriensis	1.52–1.54	2	1.53
O. anamallensis Holmgren	1.58	1	
O. ceylonicus	1.33–1.40	10	1.36
O. butteli Holmgren	1.22	2	1.22
O. dives	1.22–1.47	2	1.34
O. feacoides Holmgren	1.39	1	
O. grandiceps	1.50–1.61	8	1.55
O. horni	1.45–1.51	3	1.47
O. longignathus Holmgren	1.45–1.60	5	1.53
O. karnyi Kemner	1.51–1.54	2	1.52
O. javanicus	1.49–1.66	9	1.58
O. makassarensis	1.54–1.60	2	1.57
O. malaccensis Holmgren	1.59–1.62	4	1.60
O. sundaicus	1.55–1.62	2	1.58
O. oblongatus Holmgren	1.25–1.27	3	1.25
O. praevalens John	1.51–1.62	2	1.56
O. parvidens Holmgren	1.50–1.55	3	1.52
O. mirganjensis Holmgren	1.48	1	
O. malabaricus	1.36	1	
O. amanicus Sjöstedt	1.38–1.43	2	1.40
O. anceps (Sjöstedt)	1.24–1.60	3	1.44
O. bequaerti (Emerson)	1.52–1.59	4	1.55

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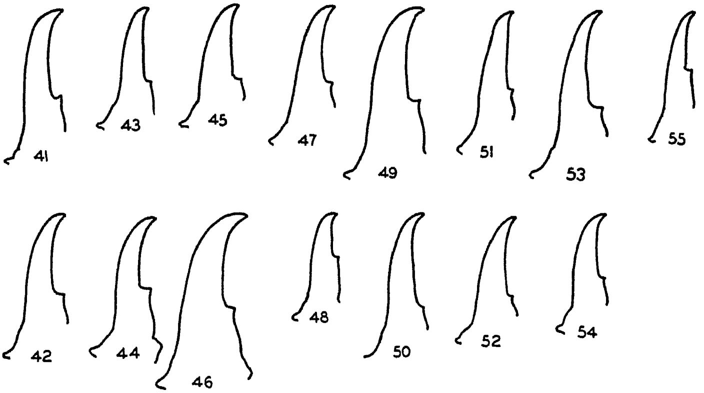
[1] The credit for authorship of this species should be given to Snyder and Emerson.

TABLE 2—*Continued*

Name of Species	Range	Number	Mean
O. badius	1.55–1.61	3	1.57
O. angustatus	1.45–1.55	10	1.49
O. fulleri (Emerson)	1.28–1.34	9	1.30
O. classicus	1.40	2	1.40
O. malelaensis (Emerson)	1.51–1.60	3	1.56
O. kibarensis	1.51–1.59	3	1.55
O. monodon (Gerstächer)	1.53	1	
O. ostentans	1.40–1.54	4	1.49
O. nilensis	1.41–1.47	9	1.44
O. patruus Sjöstedt	1.35–1.43	4	1.40
O. planiceps	1.23–1.26	4	1.23
O. nolaënsis	1.28–1.36	4	1.32
O. pauperans	1.36–1.48	5	1.43
O. vulgaris	1.42–1.54	7	1.48
O. trägårdhi	1.47	1	
O. transvaalensis	1.42–1.46	4	1.45
Species formerly included in the subgenus *Cyclotermes:*			
O. flammifrons (Sjöstedt)	1.64–1.78	7	1.71
O. zulunatalensis Sjöstedt	1.62	1	
O. bomaënsis Sjöstedt	1.45	2	1.45
O. latericius	1.57–1.59	5	1.57
O. brunneus	1.43–1.49	6	1.45
O. denticulatus Holmgren	1.63–1.75	7	1.64
O. bangalorensis	1.48–1.62	3	1.57
O. escherichi (Holmgren)	1.43–1.47	3	1.45
O. assamensis	1.50	1	
O. latigula (Snyder)	1.55–1.61	2	1.58
O. orissae	1.44	1	
O. hainanensis (Light)	1.43–1.57	2	1.50
O. formosanus	1.45–1.58	9	1.51
O. redemanni (Wasmann)	1.52–1.69	7	1.60
O. wallonensis	1.45–1.50	6	1.48
O. paradenticulatus Ahmad	1.55	2	1.55
O. sarawakensis Holmgren	1.25	1	

With these measurements also there is an overlap but without an indication of bimodality as occurred for the measurements of the postclypeus. It shows that there is no sharp distinction between the two groups on the basis of the shape of the head.

As regards the relative position and the shape of the tooth on the left mandible it appears that this character is highly variable (figs. 3–75) and as such it should not be used as a criterion for separating the two species groups. Some of the species formerly

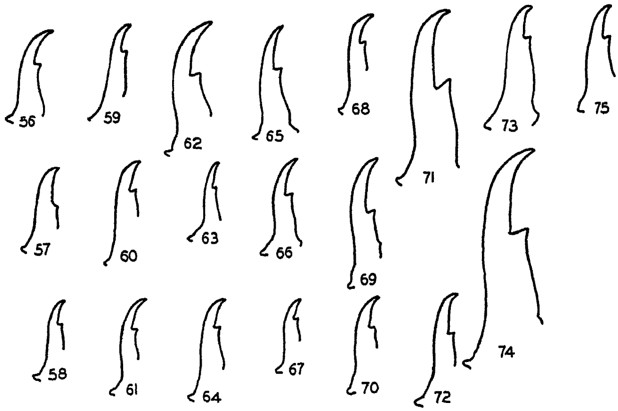


FIGS. 41–55. Left mandibles of *Odontotermes*. 41. *feae*. 42. *bogoriensis*. 43. *grandiceps*. 44. *horni*. 45. *javanicus*. 46. *longignathus*. 47. *karnyi*. 48. *oblongatus*. 49. *praevalens*. 50. *parvidens*. 51. *makassarensis*. 52. *sundaicus*. 53. *mirganjensis*. 54. *malabaricus*. 55. *malaccensis*.

assigned to the subgenus *Odontotermes*, e.g., *O. scrutor* (fig. 25) and *O. vulgaris* (fig. 34), have the left mandible similar to that of many species included in *Cyclotermes*.

Below is the list of *Odontotermes* species whose soldier caste is known but is not sketched here:

Ethiopian species:
akengeensis (Emerson), Belgian Congo
caffrariae, Natal
fallax Sjöstedt, British East Africa
fockianus (Sjöstedt), German South West Africa
interveniens, Belgian Congo
lobintactus (Sjostedt), Belgian Congo
mediocris (Sjostedt), Abyssinia
okahandjae (Fuller), Dammerland
pretoriensis Sjöstedt, Pretoria
tanganicus Sjöstedt, Tanganyika
terricola, Cameroon
zambesiensis (Sjöstedt), Zambesi
Oriental species:
bellahuniensis, India
billitoni Holmgren, East Indies
boetonensis Kemner, east Celebes
celebensis Oshima, Celebes
djampeensis Kemner, southwest of Celebes
feaeoides, India
flavomaculatus, India
fontanellus Kemner, China
gravelyi Silvestri, lower Burma



Figs. 56–75. Left mandibles of *Odontotermes* (formerly included in the subgenus *Cyclotermes*). 56. *bangalorensis.* 57. *denticulatus.* 58. *escherichi.* 59. *assamensis.* 60. *formosanus.* 61. *orissae.* 62. *brunneus.* 63. *hainanensis.* 64. *latigula.* 65. *obesus* form *gurdaspurensis* Holmgren. 66. *obesus.* 67. *sarawakensis.* 68. *redemanni.* 69. *wallonensis.* 70. *paradenticulatus.* 71. *flammifrons.* 72. *bomaensis.* 73. *sulunatalensis.* 74. *simplicidens* (Sjostedt). 75. *latericius.*

holmgreni, Celebes
karawajevi John, Java
maximus, Sumatra
simalurensis Oshima, Simalur
sinabangensis Kemner, Simalur

On the basis of these data it seems best not to separate *Cyclotermes* from *Odontotermes, sensu stricto.* If *Cyclotermes* has arisen from *Odontotermes* or *vice versa* there should be some degree of consistency in characters showing phylogenetic relationship as evidenced by morphology, zoogeography, nest building behavior, termitophiles, etc. But we do not find any distinctive character which helps us to distinguish *Cyclotermes* from *Odontotermes.* The geographical distribution of these groups shows some features of possible significance—coastal distribution of *Cyclotermes* as contrasted to more hinterland distribution of *Odontotermes*, and the relative number of their species in the Ethiopian and the Oriental regions. The geographical distribution, however, fits the concept of the polyphyletic origin of *Cyclotermes.*

It is proposed that *Cyclotermes* be placed in synonomy with *Odontotermes.* A large and more inclusive category presents greater difficulties in species determination, but mere convenience of identification should not warrant subgeneric status with its phylogenetic implications. The characters discussed above may be used in keys for practical identification.

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CRITICAL NOTES ON CERTAIN *PERO* SPECIES (LEPIDOPTERA, GEOMETRIDAE)

BY JAMES H. McDUNNOUGH

At the time of its appearance, Grossbeck's "Studies of the North American geometrid genus Pero" (1910, Proc. U. S. Natl. Mus., vol. 38, pp. 359–377, pls. 13–16) was an excellent piece of work and served to clear up a great deal of the existing muddle regarding the identity of the closely similar species in this very difficult group. As time has progressed, however, taxonomists require more and more accurate details regarding types and type localities than were considered necessary in the early part of this century and which, in consequence, were not definitely dealt with in Grossbeck's revision. As the Grossbeck collection is now incorporated in the collection of the American Museum of Natural History and as it includes the greater part of the *Pero* material discussed by him, including types of his new species and a certain proportion of his slide material, it would seem to be of considerable value to rectify, as far as possible, some of these omissions and incidentally to correct a few unfortunate errors which the author had allowed to creep into his work.

One of the main omissions is found in the explanation of the plates where, apart from the specific name, both as regards the figures of the adults and those of the male genitalia, no further details are given to indicate the origin of the specimens which served for illustration. In the case of the adults it has been possible in virtually every instance by careful comparison to find the figured specimens in the collection. With regard to the genitalic figures the investigation was less successful; it is true that slides were found from which obviously some of the figures had been drawn, but these in most instances bore no data which could be used in tying them up with pinned specimens and, to confuse the issue still further, there was virtually no material in the collection from which abdomens were missing. It might also be mentioned that in the drawings an important portion of the male genitalia, which seems to be a sort of subscaphium, had been entirely omitted. This is unfortunate as frequently excellent differentiating characters are found in the shape of this section.

Another stumbling block occurred when it came to designating the lectotypes of Grossbeck's new species. An examination of the various type series in the Museum collection showed that the custom of the time had been followed in labeling a "Type male" and a "Type female" and marking each of the remaining type specimens "Cotype." At some later date Grossbeck had actually attached a further label reading "lectoholotype" to the male type. This action would seem to settle the issue very satisfactorily if it were not for the fact that the concluding line of several of the descriptions mentions a certain type number in the United States National Museum, the corresponding specimens according to Mr. Hahn Capps being, however, merely labeled "Cotypes" and differing markedly in locality labels from the "types" in the American Museum collection. It is not proposed at the present time to solve this delicate nomenclatorial puzzle, especially as in all probability no change in the accepted specific identities would result. However, full details regarding localities will be supplied in the following discussion which deals with each individual species as it occurs in Grossbeck's revision.

Pero honestarius Walker

The male and female specimens figured on plate 13, figures 1 and 2, are both from Elizabeth, New Jersey, the male bearing the date August 20, and the female, August 15, and belonging therefore to the summer brood. The basal two-thirds of the primaries in the male, especially the areas before the t.p. lines, are deep black brown, and the specimens can scarcely be distinguished from one of the spurious male types of *atrocolorata* Hulst labeled "N. Y." from the Slosson collection in the American Museum of Natural History. This has at some time or other received the additional label "lectoholotype," ignoring Grossbeck's restriction on page 365 of his study. The female primaries are in general light brown with an intensification of the shade basad of the t.p. line. It is impossible to fix a type locality for the species, as Walker's male type bore no locality data and his male type of *stygiaria*, a synonym, was simply recorded as from North America. As regards the drawing of the genitalia, a number of Grossbeck's slides with the specific name and the number 5072 have been examined. Some are without locality data, but of four slides labeled "Elizabeth, N. J." one corresponds very closely to the figure and was probably the basis for the illustration. No specimen, however, exists in the collection without abdomen, so this reference must remain indefinite.

Pero giganteus Grossbeck

The specimen figured on plate 13, figure 3, is a female "Cotype" from Provo, Utah, August 14, 1908, T. Spalding. There is no female "Type" in the collection, but the male "Type" with additional label "lectoholotype" is present and from the same locality and collector, dated August 7, 1908. Among the "Cotypes" are five females from Provo, Utah, two males and two females from Stockton, Utah, a pair from Duncan, Vancouver Island (listed as Vancouver by Grossbeck), a worn female from Kaslo, British Columbia, a rubbed female from Tacoma, Washington, a male from Chimney Gulch, Golden, Colorado, and two males from The Dalles, Oregon (listed as Dally), these last three specimens being smaller and possibly not conspecific. All these localities are given by Grossbeck, under the heading "Habitat." A good deal of the British Columbia material was probably returned to Barnes.

The male type is very similar to the figured female in maculation; the basal area of the primaries before the t.a. line is distinctly grayish; the median area is smoky brown, particularly deep on the basal side of the t.p. line, the costal area being lighter and showing slight ruddy suffusion before the thin white discal mark; the subterminal area is quite pale, almost whitish, and the terminal area slightly darker and pale olivaceous. In the female rather bright brown shades of varying intensity prevail in the median area, but the basal area is even more contrastingly grayish.

Judging by the data on the figured specimen and on the "male type" as well as by the preponderance of Utah specimens among the author's cotypes, it might be considered that the intention of the author was to consider Utah as the type locality. However, the specimens in the United States National Museum under Type No. 13124 are a male and two females collected by Dyar on his 1903 trip to the Kootenay region of British Columbia. Should it become necessary at some time or other to split the species into racial forms there will be a difficult decision to make as to the correct type locality. It might be noted that in all probability a Cassino and Swett name is available for Utah material.

No genitalic slide material of the species could be found in the collection.

Pero peplarioides Hulst

A serious error of misidentification seems to have been made by Grossbeck with regard to this species. It was described (1900, Canadian Ent., vol. 30, p. 218) as *Marmarea peplarioides* from a presumable male collected by Kunze in the San Francisco Mountains, Arizona, on July 23, 1897, the genus *Marmarea* having been erected by Hulst (1897, Trans. Amer. Ent. Soc., vol. 23, p. 379) for *occidentalis* Hulst and distinguished from *Pero*, or *Azelina* as it was then called, by the "heavy, dentate, somewhat lamellate" male antennae as compared with the simple ciliate antennae of other species. In Dyar's list of 1902, Hulst placed it as a variety of *occidentalis*. Granting that Hulst at times made curious errors, it seems hardly likely that he would fail to recognize characters of one of his own genera, and it may therefore be presupposed that the type specimen of *peplarioides* actually possessed dentate antennae.

Turning to Grossbeck's conception of the species we find that the long series in the collection consists almost entirely of southern California specimens, mostly from the San Diego region. The male figured on plate 13, figure 4, bears no locality label but merely a date, "6-17"; it is, however, obviously a specimen from the above-mentioned locality. The female, figure 5, is from "San Diego, 4.15.09, Geo. H. Field." In the structure of the male antennae the figured male and other males in the series do not agree with Hulst's diagnosis of *peplarioides*, having simple, ciliate antennae; in fact they belong to the species later described by Cassino and Swett as *macdunnoughi*

(1922, Lepidopterist, vol. 3, p. 141), an identity that was already hinted at in a former paper (1945, Canadian Ent., vol. 77, p. 67).

As regards Grossbeck's genitalic slides, three of these have been found bearing the number 5074, and "California" as well as the specific name; one is further marked as "typical form." None of these slides can be definitely tied down to the figure given on plate 15, figure 2, which is possibly a composite drawing. However, they all agree in the general characters and, it might be noted, show the form of subscaphium noted in the 1945 paper, above mentioned, as characteristic of *macdunnoughi*. No specimens in the series are without abdomens.

Concerning the true *peplarioides* information was kindly supplied by Dr. J. B. Schmitt that the Hulst collection at Rutgers University contained no type and only a single specimen was labeled with the specific name; this on examination proved to be another *macdunnoughi* with label in Grossbeck's handwriting. In the American Museum collection a male specimen was found bearing the exact data of the original description of *peplarioides* and, further, showing distinctly serrate antennae as in *occidentalis*. Although it lacks Hulst's type label it seems extremely probable that it actually is the specimen on which the original description was based. How it came to be in the collection cannot now be ascertained and perhaps had better not be inquired into too fully. If not the type, it at least is topotypical, and it is proposed to designate it as the lectotype, as no type specimen can be located. It will fall into a group with *occidentalis* and *colorado*. A slide has been made of the genitalia, and these prove very similar to those of *occidentalis* as figured by Grossbeck. The aedeagus, however, shows no apical chitinous plate but merely a very slight knob on the left apical side when viewed ventrally. The vesica shows a small patch of fine spicules in the central area, and there are indications of still fainter ones apically. The subscaphium is broad in the apical half, somewhat bent ventrad with rounded caudal edge and a slight indication of a medioventral ridge; the basal half is broad, flat with a gently excavated cephalic margin. The coloration and maculation of the primaries of this lectotype are very similar to those of *macdunnoughi*, and the course of the t.a. and t.p. lines is scarcely to be distinguished, although the termination of the latter line at the inner margin appears slightly more upright. The initial portion of the t.a. line is heavily marked. There is little trace of any ruddy suffusion preceding the pale discal mark and this is distinctly angled, although quite thin.

Pero behrensarius Packard

The specimen figured on plate 13, figure 7, is a female, simply labeled "Oregon." Besides this the collection contains only two very worn specimens from the Henry Edwards' collection, a male without abdomen labeled "Sierra Nev. Cal." and a female from "Oregon." A very much broken slide with no locality label and another slide labeled "Oregon, Wright" have been found but neither can be said definitely to have formed the basis for the illustration on plate 16, figure 4. The identification of the species is correct.

Pero occidentalis Hulst

The figure of this species on plate 13, figure 12, is based on a male specimen listed under "Habitat" as Sierra Nevada, California. This is from the Henry Edwards' collection and bears his number 133 on the label; this number in his original catalogue cites Alameda County, June, as the locality, a statement which is rather puzzling unless one considers the Sierran label as a sort of stock label attached to Californian species in general. As a rule the entries in the catalogue are very reliable and more likely to be correct than the rather vague labels found on specimens. Hulst's locality "California" is certainly not very illuminating, but it is quite possible that he obtained the type specimen from one or other of the San Francisco collectors, in which case Alameda County would be a more likely type locality than the mountainous region to the east. Besides the figured specimen the collection contains two more males with similar label and a pair from "Oregon." All these specimens have a distinctly yellowish brown tinge over the paler areas of the primaries probably due to age. Several fresh specimens from Marin County, collected by W. Bauer, are much deeper in color, and the brown coloration shows a faint but distinct ruddy shade. Two rather crushed slides, No. 5077, labeled "Oregon," are in the collection and one of these has undoubtedly served for the illustration on plate 16, figure 6, and has been so marked. The subscaphium shows a strong ventro-median ridge terminating in a blunt apical projection and preceded cephalad by a cluster of fine spicules.

Pero modestus Grossbeck

A long series of type material, predominantly from Arizona localities (Yavapai County; Palmerlee, Cochise County) is contained in the collection. The "type male" and "type female" are from Yavapai County, Arizona, August 10 and August 26, respectively, and are part of the material collected by Otto Buchholz in the vicinity of Prescott. The specimen figured, however, on plate 13, figure 13, is a cotype female from Glenwood Springs, Colorado, August 16–23, originally from the Barnes collection and the only specimen from this locality in the collection. This specimen is somewhat lighter brown in coloration than the Arizona type, especially in the median area, but in size and maculation matches it very closely, close enough to leave little doubt that it belongs to the same species.

Three slides have been found, No. 4748, with the label "Azelina modestaria." Two of these have the additional note "Arizona" and from one of these, a rather crushed preparation, the drawing has undoubtedly been made and is quite accurate except that a faint spiculate patch present in the vesica is not indicated. In the shape of what Grossbeck calls the clasper the three slides differ slightly, notably in the prominence of the so-called heel. In view of the variability of the type series in coloration it is difficult to decide whether such differences have specific value, especially as there is no positive means of associating these slides with actual male specimens, although several in the series lack abdomens. However, further slides made from the "type male" and a similarly colored "cotype" from the same locality show pretty conclusively that the slide on which the drawing was based was made from one of the Yavapai County males.

The type male and a series of six cotypes, labeled Yavapai County, all agree in showing virtually no light brown shading on the primaries in the median area, the color of this area below the cell being light smoky brown with deeper shading along the t.p. line. The costa and the area before the small discal mark are paler, inclining to ochreous with a very faint ruddy tinge. The outer section of the wing is pale olivaceous with slight smoky sprinkling. The type female and another six cotypes from the same locality show an even heavier smoky suffusion in the median area than is found in the males, but a small patch in the cell before the discal mark is generally quite definitely tinged with ruddy. A fine black terminal line, running from the median angle of the wing to the tornus and thence along the inner margin almost to the t.a. line, seems to be a female characteristic as it has not been noted in the male to any great extent. In the cotype series from Palmerlee three males agree in coloration with the Prescott males; six males, however, show a light brownish suffusion over the median area and a similar coloration occurs in one male and two females from the Prescott series. Genitalic slides made from both the light and dark forms from the Palmerlee material show only the slightest differences among themselves; all, however, differ from the Yavapai material in having a less sharply defined heel portion of the "clasper." As in other respects, including the shape of the subscaphium and the octavals of the eighth ventral segment, they agree, it is probable that no particular weight should be placed on what is, after all, a very slight divergence. It might be noted that the subscaphium, viewed ventrally, shows the apical section hollowed out as usual and bending ventrad; the caudal margin is conically rounded, forming a slight median point; at the junction with the flatter posterior half is a small median tooth, at times hardly visible; there are no such strong projections as in *macdunnoughi*.

Most of the localities mentioned by Grossbeck under "Habitat" are represented in the collection by material, frequently, however, by single females. Some of this material seems rather out of place and will have to be further studied when more specimens are available. Among the Stockton, Utah, cotypes are several which would fall to the later described *grossbecki* Pearsall which may or may not be a good species. Other Stockton specimens, however, appear correctly placed under *modestus*. A few males from Fort Wingate, New Mexico (*ex* collection Barnes), not marked as cotypes, look most incongruous, the t.p. line of primaries showing a very strong incurve and being bordered outwardly by dark shading which in turn is followed by a quite broad, whitish band; the terminal area shows dark shading below the apex. In the genitalia there seems nothing very characteristic whereby the form might be distinguished from Yavapai County material except in very minor differences in the shape of the subscaphium and the octavals, but with more and better material available a distinct race or even species might be indicated.

The "Cotype" material in the United States National Museum under Type No. 13125 consists of three males from the

Argus Mountains, California, a female from "So. Ariz.," and another female from Las Vegas, New Mexico. These localities are so widespread and diversified that there is a distinct possibility that the Argus Mountain males will not agree well with the Prescott and Palmerlee material. This again brings up the unfortunate question of type restriction.

Life history studies to determine whether the species is single or double brooded are very essential to accurate specific definition; if double brooded, size and coloration of each brood may play an important role.

Pero morrisonarius Henry Edwards

This species, originally described from the state of Washington, proves to have a wide range across the entire continent. The specimen figured by Grossbeck on plate 13, figure 6, is a male from Big Indian Valley, Catskill Mountains, New York, and is correctly identified. Several slides made from western material were found in the collection and it seems probable that a specimen from Arrow Lake, British Columbia, formed the basis for the figure on plate 16, figure 7. One of the easiest characters for identification of the males is found in the large, bulging octavals which may be readily examined *in situ*. In the genitalia the terminal armature of the aedeagus and the thin nature of both portions of the clasper are diagnostic. The species is apparently single brooded, occurring in June and July.

Pero colorado Grossbeck

In a previous article a male specimen from Durango, Colorado, in the United States National Museum (*ex* collection Barnes) was rather prematurely designated as the lectotype (1945, Canadian Ent., vol. 77, p. 68), as it was erroneously assumed that all the specimens of the type series had been labeled "cotypes." It now turns out that Grossbeck's "type male" and "type female" are the specimens figured on plate 13, figures 8 and 9, both from Durango, Colorado (Barnes collection), the male with the date July 24–30, and the female, July 8–15. The series contains further a cotype male with same data as the female and another male from Glenwood Springs, Colorado, June 24–30, also from the Barnes collection. All the males show the distinctly serrate antennae mentioned in the original description.

A slide made of the genitalia of the type male does not at all agree with Grossbeck's figure on plate 16, figure 8. It does, however, agree with a slide, kindly made by Mr. Hahn Capps, of the above-mentioned lectotype, so at least no change in the conception of the species will be necessary. In Grossbeck's slide material, a slide, No. 4272, was found labeled "*Azelina coloradensis,* Colorado" which almost certainly served as the original for the erroneous drawing, but unfortunately the specimen from which it was made was not indicated unless, indeed, it be a worn male without abdomen and with ciliate antennae from "Denver, Colorado, Barnes Collection" for which there is, of course, no definite assurance. The slide must be considered as that of *morrisonarius* or of a very closely allied form and not of *colorado.* Another slide in the collection, No. 4748, was labeled "*Azelina modestaria,* Durango, Colo. Barnes" and agrees excellently with the slide of the male type of *colorado;* the specimen from which this slide was made is not in the collection, however, although it would appear to be topotypical of *colorado.* It is not surprising that Grossbeck confused it with *modestus,* as the genitalia in the two species are extremely similar in all respects except in the shape of the subscaphium which in *colorado* shows a stronger medio-apical projection on the ventral side, continued cephalad for a short distance by a slight ridge. The small projection at the junction of the curved apical half and the flatter basal section found in *modestus* does not appear to be present in *colorado* but is replaced by a cluster of weak spicules, as in *occidentalis* but finer. It is possible that Grossbeck had not recognized the differences in the structure of the male antennae between *colorado* and *modestus* until some time after the slides had been made which would account for the erroneous labeling and for the inclusion of "Durango, Colorado" in his list of localities for *modestus,* an error he failed to rectify.

In the male genitalia *colorado* approaches very closely to the true *peplarioides,* both species lacking the small, apical, chitinous plate in the aedeagus found in *occidentalis.* The subscaphium of *peplarioides* appears to be longer and broader than that of *colorado* and the apical projection not quite so well developed, as far as can be told from the limited material available.

Pero marmoratus Grossbeck

Both male and female types are figured on plate 13, figures 10 and 11, respectively, the former from Chester, New Jersey, and the latter from Cohasset, Massachusetts. The cotype series contains eight males, mostly from the same localities, but single specimens are present from Newton Highlands, Massachusetts, Scranton, Pennsylvania, and New Windsor, New York. Three slides of the genitalia have been found, No. 5082, one labeled Cohasset, Massachusetts. The drawing, as far as could be told, was probably made from a slide without locality label, and this has been marked accordingly. The thin aedeagus separates the species from the others discussed in the present article. The subscaphium has the apical portion drawn out ventrally into a long beak-like process. The cotype material in the United States National Museum under Type No. 13126 again differs considerably in locality from the figured specimens. It consists of a male from "Cambridge, Md. May 24," another male labeled "Pa.," and a third male without locality. A single female from Washington, D. C., is also represented.

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NOTES ON PHALAENINAE (LEPIDOPTERA)

BY JAMES H. MCDUNNOUGH

GENUS **EUXOA** HÜBNER

Recently, with a view to testing the value of the female genitalia as a means of specific separation in this complicated genus, an investigation of these organs was initiated. Unfortunately, owing to the transference of my entomological activities from Ottawa to New York, this work had to be temporarily abandoned in its initial stage. However, such interesting results had already been obtained from a study of comparatively few North American species as to make it advisable at least to call the attention of lepidopterists to certain structural characters which appear to hold considerable value not only as a means of separating closely similar species but also as showing specific relationship.

The species examined consisted, roughly speaking, of the first 25 or 30 as placed in the 1938 "Check list." One of the outstanding features which strikes the investigator's eye is the position of the exit of the ductus seminalis from the bursa. Normally this originates on the left side of the bursa at or near the proximal end. In the *ridingsiana* group, however, it is found on the right side near the middle, linking up with the *subconspicua* group of Kozhantshikov's subgenus *Menada* (1937, Faune de l'URSS, Lepidoptères, vol. 13, no. 3, fam. Noctuidae [subfam. Agrotinae], pp. 526, 624). In *edictalis* Smith it occupies a unique position, arising from the fundus on the left side. This species further shows characters which were not met with in any other of the species studied, the bursa being U-shaped, bending to the left in its distal half, and possessing a small blind sac arising in the median section on the right side. Just how much value should be placed on the shape of the bursa is, however, a matter that can be decided only after much further study, although Kozhantshikov uses this character extensively in his work on the Russian fauna. The feature on which, at the present time, it is desired to place particular emphasis is the character of the anal or ovipositor lobes. These show a surprising amount of variation but can be roughly divided into three categories. In the first type the lobes are completely covered with fine setae of variable length and thickness; such a condition is found in *olivia* Morrison, *laetificans* Smith, *brevipennis* Smith, and a number of other species. In the second type the lobes are supplied with thick, short spines, especially along the opposing edges; this feature is rarer but is well exemplified in *cicatricosa* Grote and Robinson and is very useful in correlating its various forms and separating it from closely similar species such as *quadridentata*, especially as the structure can be easily observed without the necessity of making a slide. In the third type the lobes terminate in short, non-setose, chitinous projections which frequently bend outward, the remainder of each lobe being finely setose. The size of these projections or knobs is quite variable, being short in *quadridentata* Grote and Robinson, better developed and somewhat outbowed in the *plagigera* group, and very strong in *cinereopallida* Smith, thus at once distinguishing it from *cicatricosa* with which it has been so often confused. The *ridingsiana* group also falls here on this character.

Using characters such as are above mentioned, I prepared a tentative key to the species studied. While in all likelihood this will stand in need of a certain amount of revision, it is presented at the present time as the best means of calling students' attention to characters which may readily prove to have considerable taxonomic value.

1. Ductus seminalis arising from right side of bursa........*ridingsiana* group
Ductus seminalis arising from left side of bursa............................2
2. Ductus seminalis from fundus of bursa; finger-like sac attached to right side at middle..*edictalis*
Ductus seminalis at or near proximal end of bursa.......................3
3. Ovipositor lobes completely setose with more or less rounded apices.......4
Ovipositor lobes terminating in short, chitinous, non-setose knobs, frequently divergent 13
4. Ovipositor lobes furnished dorsally with heavy spines in apical and inner areas...5
Ovipositor lobes without heavy spines, finely setose dorsally with longer hairs at bases..8

5. Heavy spines scattered over apical third or half of lobes; other spining weak...6
Heavy spines confined to an irregular row along inner margin of lobe; other spining stronger.......................................7
6. Spines short; a row of strong long setae across base of lobe........*dargo*
Spines longer and stouter; setal row at base of lobe composed of extremely fine hairs...*melura*
7. Heavy spines arranged more or less in single row; ductus bursae only slightly exceeding apex of anterior apophysis..........*cicatricosa*
Heavy spines more numerous and wider spread; ductus bursae longer, reaching well beyond apex of anterior apophysis...........*detersa*
8. Bursa bilobed, the left lobe half the size of the main bursa; anal lobes narrow and pointed; ductus bursae very long ....*flavidens*
Bursa not bilobed; anal lobes less pointed.............................9
9. Ductus bursae short and broad. Bursa long and rather narrow with slight median constriction.................................*olivia*
Ductus bursae long and narrow...10
10. Ovipositor lobes weakly chitinized, clothed with fine setae.............11
Ovipositor lobes more strongly chitinized with more numerous and thicker setae..12
11. Bursa broadly oval, rather chunky. Ductus bursae entering on right side somewhat below apex of bursa...........................*andera*
Bursa broad in proximal third, narrowing to a long, finger-like section; entrance of ductus bursae more central on caudal margin of bursa ....*holleman*
12. Bursa chunkily oval; entrance of ductus bursae at right upper corner; ovipositor lobes moderately short with well-separated apices...*brevipennis*
Bursa longer and narrower with less prominent projection to left; ovipositor lobes narrow and approximate along inner margins.......*laetificans*
13. Lobes narrow and tapering, separated apically by a deep V-shaped incision 14
Lobes broader with less pointed apices and inner margins closely approximate...15
14. Chitinized portion of ductus bursae long, extending far beyond apices of anterior apophyses. Bursa moderate, narrowing towards fundus...*niveilinea*
Chitinized portion of ductus bursae shorter, extending only to apex of anterior apophyses. Bursa much longer and narrower.........*xasta*
15. Chitinous knobs of lobes weak; ductus bursae short; bursa short, chunky ....*quadridentata*
Chitinous knobs of lobes strong, the chitinization extending backward as a ridge along the opposed edges..................................16
16. Lobes short and broad. Ductus bursae very short and broad, entering bursa on right side below apex....................*cinereopallida*
Lobes narrower. Ductus bursae moderately long to very long. Apical knobs strongly chitinized and divergent..........................17
17. Chitinous knobs joined together in median line. Ductus bursae reaching to

apex of anterior apophyses and entering bursa on right side below apex . . . . *atristrigata*
Chitinous knobs separated apically 18
18. Ductus bursae scarcely extending beyond apex of anterior apophyses, entering bursa in upper right-hand corner . . . . *nevada*
Ductus bursae extending far beyond apex of anterior apophyses 19
19. Ductus bursae entering bursa on its caudal margin. Bursa with long, narrow distal half . . . . *plagigera*
Ductus bursae entering bursa well down on right side. Bursa short and chunky 20
20. Lobes short and widely separated when viewed ventrally . . . . *olivalis*
Lobes more closely approached on ventral side. Segment containing genital opening longer and narrower. In general very close to preceding . . . . *oblongistigma*

When more complete study can be devoted to the group it is probable that relationships will be disclosed that will result in considerable changes in the sequence of species as at present listed. For the present all that can be done is to call attention to some of the most obvious changes which have been brought to my attention partly as a result of this genitalic study and also during revisional work on the material in both the Canadian National and the American Museum collections.

Euxoa detersa Walker

This very variable species should certainly be placed next to *cicatricosa* Grote and Robinson. The female ovipositor lobes show the same type of heavy spining found in *cicatricosa*, and there is very little tangible difference in the male genitalia. The species is widespread and essentially an inhabitant of sandy areas. The typical eastern seacoast form is fairly readily separable from *cicatricosa* and would appear to have slightly stronger fasciculations in the male antennae than those of the western species, but this feature may be inconstant. The maculation of the primaries varies greatly in any one locality from well-marked specimens with pale costa (typical) to unicolorous pale gray ones with obsolescent cross lines. Farther west the same species is found along the shores of the Great Lakes, and the name *azif* Strecker, based on material taken near Rochester, New York, may be used, if desired, for the form from the lower lakes region. It varies from gray to reddish in the coloration of the primaries, the latter color being that of Strecker's type, but apparently lacks the pale costa found in the type form. A series from Port

Colborne, Ontario, is held under this name in the Canadian National collection. *Personata* Morrison, listed as a race, was described from specimens from Illinois, taken by Dodge, and should probably be tied down to the much darker form that occurs in the sand-dune areas at the southern end of Lake Michigan. A very similar form occurs in the dune areas of Manitoba and Saskatchewan and especially in the latter province seems to merge into *cicatricosa,* extending northward through Montana from the semi-arid regions of the more southerly Rocky Mountain states. In fact, as yet, no definite distinguishing character has been found by which the two species may be separated, although the reduction of the frontal tubercle and the small pale round orbicular of *personata* are sometimes useful, as well as the darker border on the secondaries of the male.

Euxoa orbicularis Smith

The identity of this species, described from a single female from Nevada in the Tepper collection, now in the museum collection at East Lansing, Michigan, has always been a matter of doubt. After a careful study of an excellent photograph of this type it would seem best considered as one of the numerous forms of what is now known as *misturata* Smith and would take priority as the name of the species. The small, round orbicular, which gave rise to the specific name, is quite characteristic in this whole complex. A small series in the Canadian National collection from the Ivanpah Mountains, San Bernardino County, California, close to the Nevada border, seems to match Smith's description fairly well, the ground color of the primaries being considerably paler than that of typical *misturata* from Colorado. An examination of the ovipositor lobes of the type should be useful in verifying the above placement, as these show strong, outbowed, chitinous projections apically in *misturata* and its other forms.

Euxoa redimicula Morrison

Apparently two species have been masquerading under this name. As early as 1911 that keen observer F. H. Wolley Dod called attention to this (Canadian Ent., vol. 43, p. 396) in his notes on Alberta Lepidoptera and one cannot do better than repeat a portion of his text. He says, under the title *redimicula:* "The form occurring here [i.e., Calgary] is that figured by Sir

George Hampson from Colorado. Much the same form occurs in the East and I have a male from New York differing chiefly only in being browner and less grey. But a form occurring much more commonly in the East is more even in colour, has slightly larger and rounder discoidal spots, more even s.t. line without the inward streaks, and paler, dark margined secondaries. So unfamiliar did the form seem to my eye, that I made sure it was a distinct species. Mr. Winn has taken both forms flying together at St. Hilaire, Quebec and it was in his material that I first claimed to be able to recognized two species." He goes on to state that the more he examined the specimens the less able he was to draw a line between them but was still of the opinion that "the existence of two species [is] quite possible." How accurate his observations were has recently been proved by an examination of the ovipositor lobes of females of both types contained in the Canadian National collection (including Dod's long series) and in the American Museum collection. The two forms can readily be distinguished on easily seen characters found in the shape and spinulation of these lobes. In the case of the larger, darker, eastern form the apices of the lobes are produced into long, chitinous, slightly outcurved projections, the chitinization being extended cephalad along the inner margins of the lobes for a considerable distance. The spinulation is heavy and consists of short, moderately stout setae, especially numerous along the latero-caudal edges when viewed dorsally. Along the cephalic margin of each lobe is a curved row of long setae, a character generally found in *Euxoa* species. The paler Calgary and Colorado form, which also extends into the east where it assumes a somewhat modified coloration, shows no projections of the apices of the lobes, these being rather bluntly pointed. The apical half of each lobe on the dorsal side is sparsely covered with extremely stout, short, rather bluntly pointed spines, interspersed occasionally with longer, finer ones. Towards the cephalic end of the lobes these spines diminish greatly in size and number. The usual row of long setae occurs just above the cephalic margin. In other structural details the whole genital organs show great similarity; a reference to figure 7 should elucidate these points.

When the fact that two distinct species are involved is recognized, it becomes a matter of considerable interest as to which of these species Morrison's name *redimicula* is applicable. The

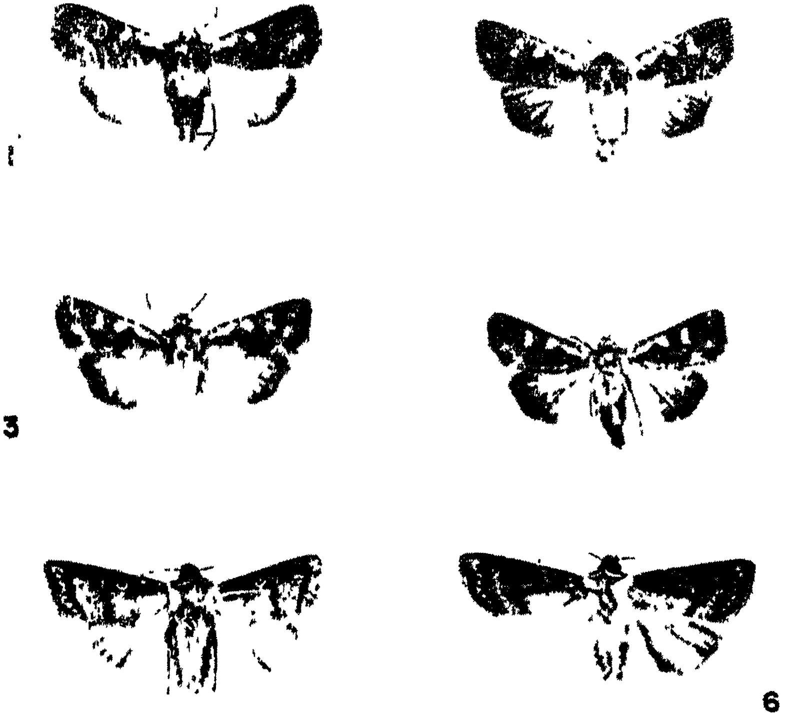

FIG. 1. *Euxoa redimicula* Morrison, male, Litchfield, Connecticut.
FIG. 2. *Euxoa redimicula* Morrison, female, Mystic, Connecticut.
FIG. 3. *Euxoa servita* Smith, male, Franconia, New Hampshire.
FIG. 4. *Euxoa servita* Smith, female, Orono, Maine.
FIG. 5. *Agrotis dentilinea* Smith, lectotype, male, "Sier Nev. Cal."
FIG. 6. *Agrotis semiclarata* Grote, male, Kaslo, British Columbia.

original description is very brief and inadequate, stating: "Ground color cinereous, suffused with black. A large thick, basal, black dash. The ordinary spots and another costal spot at the base, clear cinereous, contrasting. *Claviform spot small* [the italics are mine]." The localities given are Colorado, Albany, New York, and Massachusetts, and most probably, therefore, the type series included specimens of both species. The reference, however, to a small claviform can apply only to the larger, darker, eastern form, and it is proposed to limit the name to this form, irrespective of any "type" that may still exist in the Tepper collection as stated by Smith (1893, Bull. U. S. Natl.

Mus., vol. 44, p. 107). A year later Morrison amplified his original description, changing the error of *redimacula* to *redimicula* and adding more eastern localities. He still emphasizes the "small black claviform spot" and makes no mention of a paler subterminal area, a feature very pronounced in Alberta and Colorado specimens. His original Massachusetts record is given as "Boston, Massachusetts (H. K. Morrison)," and as it would seem quite feasible for him to draw up an original description from a specimen of his own collecting it might be well to consider this specimen as typifying the true *redimicula.* The figures presented are from Connecticut material, but there is a female from Lenox, Massachusetts, in the American Museum of Natural History which matches these very closely.

As regards the second species, the name *servita* Smith (1895, Ent. News, vol. 6, p. 336, pl. 15, fig. 8) appears definitely applicable. It was based on single females from Colorado (Bruce) and Calgary, Alberta, and while the specimens are undoubtedly rather aberrant, judging by Smith's figure and the rather poorly colored one given by Hampson (1903, Catalogue of the Lepidoptera Phalaenae in the British Museum, vol. 4, pl 66, fig. 29) they show in general all the characters of this smaller, paler form. Rocky Mountain material is not difficult to distinguish from typical eastern *redimicula;* the color is much paler, especially that of the subterminal area, and, as noted by Dod, the indentations of the s.t. line are much more marked; it might be added that the t.a. line is generally more outwardly oblique, reducing the width of the median area on the inner margin considerably; the claviform is large and prominent. In the east the two species are much more difficult to separate, owing to the darker and less contrasting coloration of *servita* and the fact that none of the characters mentioned above seem to hold absolutely. Some males seem impossible to place definitely even when genitalic slides are studied, as the male organs present no appreciable differences. However, the direction of the t.a. line and the size of the claviform are very helpful as a means of separation in the large majority of specimens.

As regards the distribution the available data are insufficient to give a very definite picture. *Redimicula* occurs in the North Atlantic states quite commonly and extends northward through the New England states into southern Quebec (St. Hilaire) and southern Ontario (Chatham region). It has not been found as

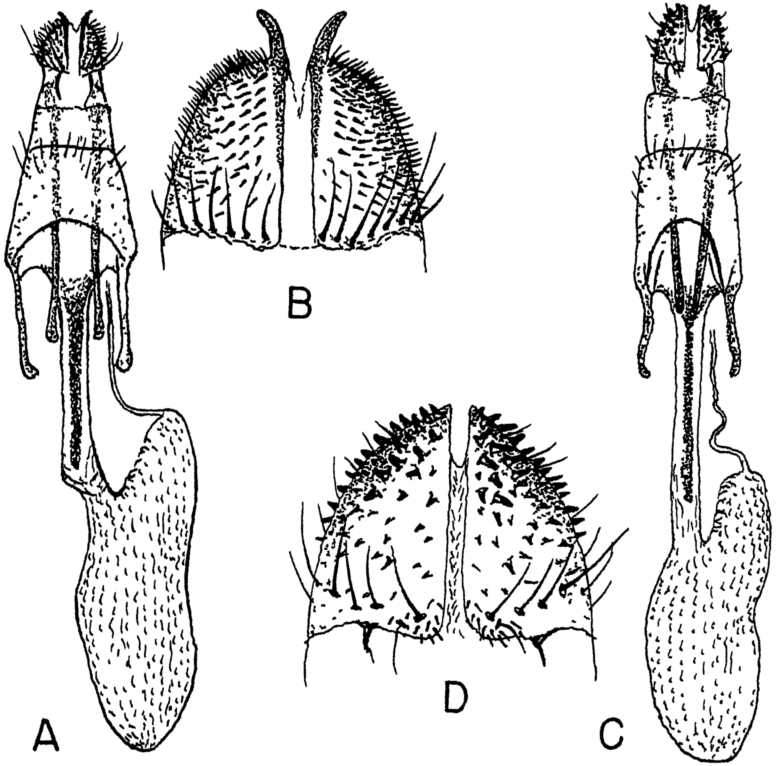

Fig. 7 A. *Euxoa redimicula* Morrison, female genitalia. B. The same, ovipositor lobes, enlarged. C. *Euxoa servita* Smith, female genitalia D, The same, ovipositor lobes, enlarged.

yet in the Prairie Provinces of Canada but appears to occur in a modified form in the south-central section of British Columbia (Lillooet, Kamloops). Only limited material from this region has been available for study in the Canadian National collection, but the female ovipositor lobes certainly are of the *redimicula* type with slight reduction of the chitinous projections. The maculation, however, is very close to that of *servita* as regards the size of the claviform and the oblique nature of the t.a. line, and in consequence placement of these specimens is very puzzling and bears out very well Dod's remark already quoted.

Servita appears to be essentially a species of the prairie and Rocky Mountain regions. It is common and very characteristic throughout Manitoba, Saskatchewan, and Alberta and extends down the mountains through Montana and Wyoming into Colorado and Arizona. As far as can be told, its range in the east is more northerly than that of *redimicula*, being largely confined to the New England states, extending westward through Quebec and Ontario (Trenton, Nipigon) to connect with the paler prairie form. The specimens figured are from New Hampshire and Maine.

Agrotis dentilinea Smith

A great deal of confusion has existed regarding the correct determination of this name. This was largely due to a very poor diagnosis (1890, Trans. Amer. Ent. Soc., vol. 17, p. 45) by Smith who neglected to state either the locality or the origin of "a number of specimens" which were "so different from the general run of specimens [i.e., of *volubilis*] that I applied the name *dentilinea* to the form." The only description given was that "the maculation is much more distinct, the colors brighter and the s.t. line very prominently dentate." While placed as a form of *volubilis*, Smith mentioned that it might "eventually prove distinct." Barnes and Benjamin (1924, Contributions to the natural history of the Lepidoptera of North America, vol, 5, no. 3, p. 114) mention that no types under the name *dentilinea* could be found in either the United States National Museum or the Smith collection at Rutgers University and state that "the name *dentilinea* may tentatively remain on lists as an unknown form of *volubilis*." In the 1938 "Check list" *dentilinea* was placed doubtfully as a form of *aeneipennis*, largely on the strength of a couple of specimens from the Wolley Dod collection in the Canadian National collection which had been labeled with this name.

While arranging the agrotid material in the American Museum collection I found three types of *dentilinea* which originally came from the Henry Edwards' collection and bore the locality label "Sier. Nev. Calif." These consisted of two males and a female and simply bore, besides the name, the designation "type," all in Smith's handwriting. One of the males can scarcely be distinguished from *volubilis* and does not agree well with the diagnosis. The other male, however, agrees excellently and it is proposed to consider it as the lectotype; it shows the brighter coloration and the prominent dentate s.t. line mentioned by Smith; besides the locality and type labels it bears the museum label, No. 9888, used in cataloguing the Edwards' collection. Based on this specimen and the female type, which, while darker, is probably correctly associated, *dentilinea* can scarcely be associated with *aeneipennis* in which the thoracic squamation is evenly light brown, similar in color to the primaries. It would appear to show more relationship to *vancouverensis* Grote, especially to the so-called variety *semiclarata* Grote. The head and the basal half of the tegulae show the same dark brown coloration with a white subapical line crossing the latter; the patagia are also pale. The primaries are broadly dark brown along the costa from base to just before the apex. The inner half of the wing below the cell is pale purplish white as far as the t.p. line, this color then extending upward as a narrow band, exterior to the line, as far as the dark costal area. The claviform is scarcely marked and shows no black, basal extension which would seem, if constant, to distinguish it from *vancouverensis* forms. The pale, dentate s.t. line is very strongly marked and is completely bordered inwardly by a narrow dark band of the same shade as the costal area on which black arrow marks are faintly discernible. The apex of the wing is pale shaded, but the balance of the terminal area is dark. The small orbicular is outlined in whitish but the reniform is scarcely more than indicated by a pale upright streak on its inner edge; between the two spots is a blackish shade. The t.a. and t.p. lines are single, blackish, the former with a strong outward loop above the inner margin, the latter dentate. A broad, upright, dark, median shade is evident crossing the paler portion of the wing, adjacent to the t.p. line. The secondaries are smoky but noticeably paler in the basal half as in *semiclarata*. The figure given should render identification fairly easy.

The exact status of *dentilinea* cannot be determined until more study has been given to the extremely complex *vancouverensis-volubilis* group, but its association with *vancouverensis* as a Sierran race can do no harm. As regards a more definite type locality than that given on the label the vicinity of Truckee might be mentioned, as it is well known that Henry Edwards collected a good deal in this area along with McGlashan.

Feltia repleta Walker

A single male of this species was found among the series of *annexa* Treitschke, taken by Mrs. Slosson years ago at Biscayne Bay, Florida; the species must therefore be added to our lists. The male antennae are bifasciculate, the fascicles much shorter than in *annexa*. The general appearance would indicate a position next to this species.

Protogygia lagena Grote

Doubt was expressed in a former paper (1932, Canadian Ent., vol 64, p 108) as to whether the types of this species in the British Museum were authentic, as they were listed by Hampson as from "Nevada," whereas the original description gave "California, Hy. Edwards, No. 2256" as the data on the type specimen. A worn female specimen bearing both Edwards' number and "California" in small print as well as a red-bordered label with the name of the species in Grote's handwriting but not marked "Type" is in the American Museum collection. Unfortunately the number 2256 in the original Edwards' catalogue gives the locality as "Virginia City, Nevada, W. T. Eaves" and thus obscures the entire issue. However, the identity of the species, as established in the above paper, is not changed, and it might be well to accept the British Museum specimens as the correct types The Edwards' collection contains further a small series labeled "Sierra Nev. Cal." which probably were collected in the region around Truckee and therefore quite close to Virginia City which might partially explain the locality mixup.

Abagrotis baueri, new species

Resembles closely the recently described *Abagrotis denticulata* McDunnough but is slightly smaller in size and with rather smoother appearing primaries, owing to the reduction of the fine blackish sprinkling. On male genitalic characters the species is very close to *barnesi* Benjamin, differing in the armature of the aedeagus.

Palpi with the second joint deep blackish outwardly, the third joint ochreous. Male antennae simple. Vestiture of head and thorax concolorous with the primaries, being a light wood brown color, but at times this is lacking and the wing then appears to be more of a deep fawn brown; the black sprinkling is slight. The t.a. and t.p. cross lines are quite indistinct, being geminate, blackish, with filling uncontrasted from the ground color; their course is much as in *denticulata* and *barnesi*. The pale s.t. line is irregular, defined by slight smoky shading on the inner side, most prominent at costa; its course is much as in the allied species. Orbicular small, circular, inconspicuous; it is outlined by a pale ring, only slightly paler than the ground color, and shows little trace of darker filling (useful in distinguishing from *denticulata*). Reniform narrow, upright, outlined in dull ochreous and with black filling in the lower half which at times spreads over the whole interior portion. Above the reniform is a small black mark on costa, the inception of the inner portion of the geminate t.p. line. A terminal series of black spots of variable intensity. Fringes smoky with a few whitish sprinkles and a light ochreous basal line. Secondaries deep smoky. Fringes much paler, shading from a light ochreous basal area to whitish outwardly and crossed by a dark median line. Beneath the primaries are smoky with costa to postmedian dark dash tinged with ochreous; secondaries ochreous with black sprinkling in costal portion, smokier on the inner area; a large, dark discal spot, at times angled, and traces of a postmedian curved line; fringes as above. Expanse 33–35 mm.

The male genitalia are closely similar to those of *barnesi* except in the armature of the vesica. In *barnesi*, as well figured by Benjamin, this consists of a single or bifid spine, projecting beyond the apex of the aedeagus as an extension of a chitinous plate, the left side of which is in alignment with the spine. In the present species the armature is internal and does not project; it consists of a single or bifid spine, attached to the middle of a broad, spreading, chitinous plate, the whole being of the rose-thorn type. The apex of the aedeagus is squarely truncate, and the median section shows a distinct striated area. The twisted, apical, hammer-like portion of the clasper is slightly narrower than in *barnesi* and the whole organ somewhat smaller, although distinctly larger than that of *denticulata*. Judging by several slides made of both *barnesi* and the present species the above differences appear quite constant.

Holotype, male, Anderson Springs, Lake County, California, July 13, 1947 (W. R. Bauer) in the American Museum of Natural History.

Allotype, female, same locality and collector, August 17, 1947, also in the American Museum of Natural History.

Paratypes, six males, three females, same locality and collector; males dated August 3, 9, 10, September 14, 28; females, August 3, 17, September 13. Of these two males and a female will be returned to W. Bauer and another pair deposited in the Canadian National Collection.

The type material was submitted by W. R. Bauer of Petaluma, California, along with specimens of *denticulata*, for identification. It is with much pleasure that the species is named after this enthusiastic collector. There is a possibility that the specimen figured by Benjamin (1920, Bull. Southern California Acad. Sci., vol. 19, pl. 6, fig. 47) as a form close to *barnesi nevadensis* from Mission San Jose, California, belongs to this species.

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FOUR NEW SUBSPECIES OF BIRDS FROM VENEZUELA[1]

BY JOHN T. ZIMMER AND WILLIAM H. PHELPS

An examination of the material in the American Museum of Natural History and in the Phelps Collection, Caracas, Venezuela, shows the following new subspecies.

The junior author extends his thanks to Dr. Herbert Friedmann of the United States National Museum, Mr. W. E. Clyde Todd of the Carnegie Museum, Mr. Emmet R. Blake of the Chicago Natural History Museum, and Mr. R. M. de Schauensee of the Academy of Natural Sciences of Philadelphia for their cooperation in the examination of material in their museums.

In the lists of specimens examined, those in the Phelps and other collections are so characterized; the remaining material is in the American Museum of Natural History.

Names of colors are capitalized when direct comparison has been made with Ridgway's "Color standards and color nomenclature."

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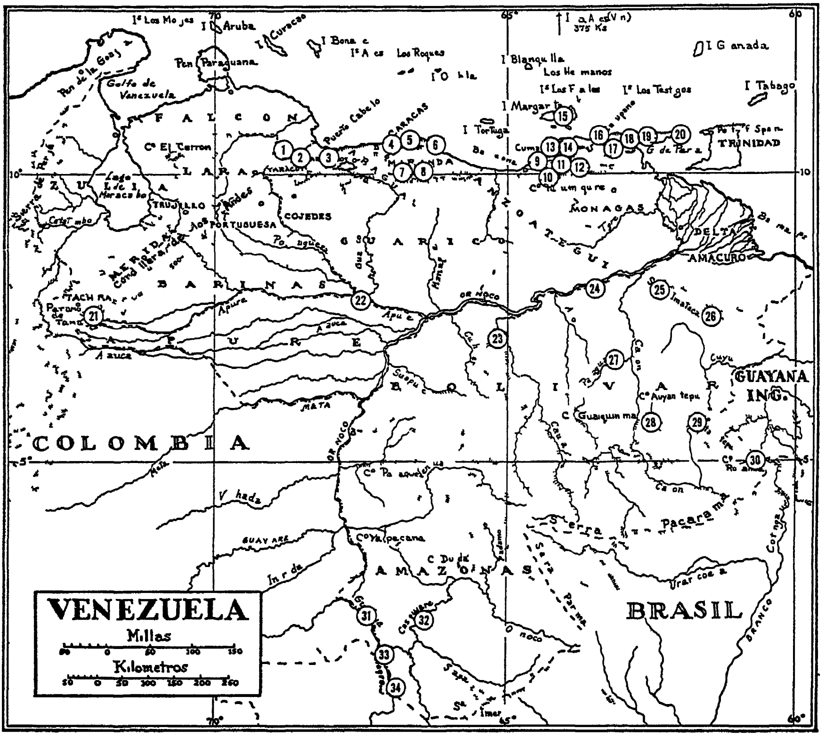
[1] Previous papers by the same authors, describing new birds in the American Museum of Natural History and in the Phelps Collection, are "New species and subspecies of birds from Venezuela. 1" (1944, Amer Mus Novitates, no. 1270), "New species and subspecies of birds from Venezuela 2" (1945, Amer Mus. Novitates, no. 1274), "Twenty-three new subspecies of birds from Venezuela and Brazil" (1946, Amer. Mus Novitates, no. 1312), "Seven new subspecies of birds from Venezuela and Brazil" (1947, Amer. Mus. Novitates, no 1338), and "Three new subspecies of birds from Venezuela" (1948, Amer. Mus. Novitates, no. 1373).



26	Altiplanicie de Nuria	2	Hacienda Panchita, Yaracuy
30	Arabupú	19	Humo, Cerro
6	Aricagua	27	La Paragua
28	Auyan-tepui, Mt	3	Las Trincheras
10	Bergantín	9	Los Altos
1	Bucaral	5	Los Caracas
11	Campos Alegre Valley	11	Los Palmales
4	Caracas	15	Margarita Island
12	Caripe	8	Negro, Cerro (Miranda)
16	Carúpano	12	Negro, Cerro (Monagas)
32	Casiquiare, Caño	33	Negro, Río
24	Ciudad Bolivar	11	Neverí, Río
4	Cotiza	19	Paria Peninsula
20	Cristóbal Colón	20	Patos, Isla de
13	Cumaná	30	Paulo
11	Cumanacoa	29	Ptari tepui, Cerro
34	El Carmen	10	Quebrada Bonita
25	El Palmar	11	Quebrada Seca
4	Galipán	30	Roraima, Mt
7	Golfo Triste, Cerro	11	Sal si Puedes
31	Guainía, Rio	14	San Antonio del Golfo

Pyrrhura leucotis auricularis, new subspecies

TYPE: From Cerro Humo, Paria Peninsula, State of Sucre, Venezuela; altitude 800 meters. No. 41008, Phelps Collection, Caracas. Adult male collected November 28, 1947, by Ramón Urbano. (Type on deposit at the American Museum of Natural History.)

DIAGNOSIS: Differs from *P. l. emma* of the Caracas region by having larger and clearer white auricular patches; green of back and flanks slightly deeper, less yellowish; bill slightly larger; wings and tail slightly longer.

RANGE: The mountains of the northeastern coast of Venezuela in the states of Sucre, Monagas, and Anzoátegui, in the Tropical and Subtropical Zones.

DESCRIPTION OF TYPE: Forehead with a narrow band of reddish brown against the bill; fore-crown and collar around nape Light Terra Verte; occiput dark sooty brown, faintly mottled with lighter brown; hind neck (behind the collar) and mantle dark Parrot Green; sides of lower back and outer upper tail-coverts lighter green; middle of lower back and rump Ox-blood Red, darker on central upper tail-coverts; sides of head Victoria Lake, extending over the malar region where the feathers have a small terminal bluish speck; large auricular patches white lightly tinged with grayish. Point of chin white; feathers of throat grayish blue with a white, subterminal cross-bar, giving a scaled appearance, and tip very narrowly dark; over the breast the feathers become more greenish with an Oil Yellow subterminal bar; flanks Cosse Green, under tail coverts a little darker; center of belly occupied by a broad patch of bright Ox-blood Red. Primaries and secondaries Fuscous-Black with the outer edges, except on the outermost quill, China Blue, duller distally and becoming greener on the secondaries and terminal part of inner primaries; inner webs, except for blackish inner margin, similarly bluish, becoming greener on the inner feathers; tips of both webs always fuscous; tertials, except for dark shafts, green like the mantle; primary-coverts and alula China

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11	San Antonio de Maturín
33	San Carlos
3	San Esteban
22	San Fernando de Apure
21	Santo Domingo
23	Suapure
27	Tigre, Cerro
25	Tomasote, Cerro
17	Tunapuí
11	Turumiquire, Mt.
18	Yaguaraparo

Blue; bend of wing Spectrum Red; rest of upper wing-coverts Calla Green, uniform with mantle; a yellowish tinge on basal portion of broad inner margins of remiges, more intense on tertials; under primary-coverts dull light grayish green; rest of under wing-coverts Cosse Green, uniform with sides. Tail Maroon, paler on under surface, the outer vanes of the rectrices on the upper surface, except the two outermost, being largely Calla Green on basal half. Bill (in life) "black"; feet "black"; iris "orange." Wing, 115 mm.; tail, 115; culmen from cere, 16; exposed culmen, 18; tarsus, 13.

REMARKS: Sexes alike. Size slightly larger than *emma*. Range of measurements (specimens from the Paria Peninsula): five adult males: wing, 115–118 (116) mm.; tail, 115–122 (117.8); culmen from cere, 15–17 (15.9); five adult females: wing, 114–120.5 (116.3); tail, 109.5–120 (111.5); culmen from cere, 15–15.5 (15.2). Measurements of *emma:* five adult males: wing, 112–116 (113.8); tail, 101–112 (107); culmen from cere, 14–15 (14.7); five adult females: wing, 106–114 (110.9); tail, 106–112 (108.7); culmen from cere, 14–15 (14.5).

The specimens from the Mt. Turumiquire region are somewhat intermediate but closer to *auricularis*.

Those in the American Museum of Natural History from the Paria Peninsula, taken in May and June, are in worn plumage, while those in the Phelps Collection from the same region, taken in August and September, are fresh and many of them with the molt incomplete.

We restrict the type locality of *emma* to Caracas. It was listed by the describer as "Caraccas and Caripé."

SPECIMENS EXAMINED

P. leucotis emma.—VENEZUELA[1]: Cerro Negro, Miranda, 1 ♂, 3 ♀; Cerro Golfo Triste, 1 ♂, 3 ♀, 1(?); Aricagua, 2 ♂; Los Caracas, 3 ♀; Hda. Panchita, Yaracuy, 3 ♂, 2 ♀; Bucaral, 1 ♂.

P. l. auricularis.—VENEZUELA: Cristóbal Colón, 6 ♂, 6 ♂,[1] 3 ♀, 3 ♀,[1] 1 (?); Cerro Humo,[1] 3 ♂ (including type); 3 ♀; Quebrada Seca 2 ♂, 5 ♀; Río Neverí, 1 ♂, 2 ♀, 1 (?); Cerro Negro, Monagas, 2 ♀[1]; Caripe,[1] 1 ♂, 2 ♀; Quebrada Bonita,[1] 2 ♂, 3 ♀; Los Altos,[1] 1 ♂, 2 ♀.

P. l. pfrimeri.—BRAZIL: Nova Roma, Goiaz, 1 ♂, 1 ♀.

P. l. griseipectus.—BRAZIL: "Brazil," 1 ♀; "Bronx Zoo," 1 ♂; Manchester Zoological Gardens, 2 ♂, no locality, 3 (?).

P. l. leucotis.—BRAZIL: Rio Doce Espíritu Santo, 1 (?); Cajazeiras, Bahia, 1 ♂; "Rio," 2 (?); "Bahia," 2(?) "Brazil," 1 (?).

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[1] Specimens in the Phelps Collection, Caracas, Venezuela.

Amazilia tobaci caudata, new subspecies

TYPE: From Campos Alegre Valley, State of Sucre, Venezuela. No. 480172, American Museum of Natural History. Adult male collected February 6, 1898, by Henry Caracciolo.

DIAGNOSIS: Differs from *A. t. aliciae* (Margarita Island) by its darker blue tail; from *tobaci* and *erythronotos* (Tobago and Trinidad islands) by its lighter, less purplish blue tail; from *feliciae* (Caracas region) by its rufous under tail-coverts; and from *caurensis* (State of Bolívar) by having paler, less purplish blue tail and rufous under tail-coverts.

RANGE: The mountainous region of the north coast of Venezuela in the states of Sucre, Monagas, and Anzoátegui, from Cristóbal Colón to Bergantín, in the Tropical Zone; Isla de Patos.

DESCRIPTION OF TYPE: Crown lustrous Peacock Green × Emerald Green, this color changing gradually to more bronzy towards the rump; upper tail-coverts dark Hazel; sides of head and under parts lustrous Peacock Green × Emerald Green; shanks, lower abdomen, and femoral tuft white; under tail-coverts dark Hazel. Remiges and greater wing-coverts Dull Violet Black (1); lesser wing-coverts bronzy green; under wing-coverts and axillaries lustrous Peacock Green. Tail Dark Analine Blue, near Alizarine Blue on under surface. Maxilla (in dried skin) black; mandible flesh color with dusky tip; feet black. Wing, 52 mm.; tail, 30.5; exposed culmen, 19; culmen from base, 23; tarsus, 4.5.

REMARKS: Sexes alike in size, but females slightly lighter and more yellowish green below. Size similar to *aliciae.* Range of measurements: type and four adult males from Caripe: wing, 50–53.5 (51.5) mm.; tail, 29–30.5 (30.1); exposed culmen, 17–20 (18.3); five adult females from Caripe and Los Altos: wing, 49–51 (50.4); tail, 27.5–28 (27.8); exposed culmen, 19–20 (19.6). Measurements of *aliciae:* three adult males: wing, 54; tail, 29–30.5 (30.2); exposed culmen, 19–20 (19.5); five adult females: wing, 51.5–54 (52.7); tail, 28–30.5 (29.5); exposed culmen, 19–21 (19.8).

Todd,[1] on comparing his specimens from the Mt. Turumiquire region with a series from Margarita Island, mentioned the possibility of separating the mainland population by the coloration of the upper parts, but he did not mention the difference in color of the tail. With a series of 20 specimens from Margarita Island and 92 from the mainland we cannot find a constant character other than the color of the tail.

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[1] 1942, "List of the hummingbirds in the collection of the Carnegie Müseum," Ann. Carnegie Mus., vol. 29, p. 326.

The constant character that we find separating *caurensis* from *erythronotos* is the coloration of the lower parts; it is lighter, more yellowish green in *caurensis*. The grayish under tail-coverts of the type and two paratypes are duplicated in four out of the 25 specimens of *erythronotos*. The Mt. Auyan-tepui population cannot be separated from *erythronotos* by the under tail-coverts inasmuch as of the 13 specimens only three are grayish while six are bronzy purple similar to 12 *erythronotos* and three are pale rufous brown similar to nine *erythronotos*. However, these are manifestly *caurensis* because of the typically more yellowish sheen to the under parts.

We have seen no specimens of *apurensis* (San Fernando de Apure), but we would be surprised if it proves to be a valid race based on such a variable character as the intensity of the bronzy color of the upper parts; neither have we examined *monticola* (Guarico, Lara).

Our large series from Cristóbal Colón and Isla de Patos shows no tendency to intergrade with *erythronotos* notwithstanding the proximity to Trinidad.

SPECIMENS EXAMINED

A. t. feliciae.—Venezuela: San Esteban, 1 ♂, 1 ♀; Las Trincheras, 2 ♂, 2 ♀, 1 (?); Galipán, 4 ♂, 2 ♀; Cotiza, 2 ♂, 1 (?).

A. t. caudata.—Venezuela: Campos Alegre Valley, 5 ♂ (including type), 5 ♀; Los Palmales, 1 ♂; Quebrada Seca, 1 ♂, 1 ♀; Sal si Puedes, 1 ♂, 1 ♀; San Antonio de Maturín, 3 ♂, 2 (?); Cumanacoa, 1 ♂, 1 ♀, 1 (?); Cumaná, 3 ♂, 2 ♀, 1 (?); Carúpano, 1 ♀; Cristóbal Colón, 2 ♂, 2 ♀. Venezuela[1]: Quebrada Bonita, 1 ♀; Bergantín, 3 ♂; Los Altos, 4 ♂, 2 ♀, 1 (?); Cumaná, 1 ♂; San Antonio del Golfo, 1 ♀; Caripe, 8 ♂, 5 ♀, 1 (?); Carúpano, 1 ♀; Tunapuí, 1 ♂, 1 (?); Yaguaraparo, 1 (?); Cerro Humo, 1 ♀; Cristóbal Colón, 4 ♂, 4 ♀, 1 (?); Isla de Patos, 2 ♂, 7 ♀, 8 (?).

A. t. aliciae.—Venezuela: Margarita Island, 2 ♀, 3 ♂,[1] 3 ♀,[1] 3 ♂ (including type),[2] 4 ♀,[2] 1 ♂,[3] 3 ♀,[3] 1 (?).[3]

A. t. erythronotos.—Trinidad: 18 ♂, 2 ♀, 5 (?).

A. t. tobaci.—Tobago: 4 ♂, 12 ♀, 1 (?).

A. t. caurensis.—Venezuela: Suapure, 1 ♂ (type); mountains west of Suapure, 1 ♀; Ciudad Bolívar, 1 ♀; Mt. Auyan-tepui, 6 ♂, 3 ♀, 3 (?).

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[1] Specimens in the Phelps Collection, Caracas, Venezuela.

[2] Specimens in the United States National Museum.

[3] Specimens in the Chicago Natural History Museum.

Basileuterus culicivorus roraimae, new subspecies

TYPE: From Paulo, Mt. Roraima, State of Bolívar, Venezuela; altitude 1200 meters. No. 237060, American Museum of Natural History. Adult male, collected November 4, 1927, by T. D. Carter.

DIAGNOSIS: Nearest to *B. c. olivaceus* (Trinidad) from which it differs by having darker, more greenish (less grayish) olive back; superciliary stripe with yellowish tinge instead of whitish; auricular region averaging more dusky; size larger.

RANGE: Eastern part of the State of Bolívar.

DESCRIPTION OF TYPE: Top of head with broad lateral black stripes joining across the posterior forehead; the feathers at base of bill mixed with grayish; a large Orange Rufous crown patch, the feathers mostly narrowly tipped with olive grayish; occiput centrally grayish olive separating the black stripes; back slightly greener than Deep Olive; uropygium approaching Yellowish Olive; a pale superciliary stripe Marguerite Yellow with grayish tips; lores whiter; auriculars dusky. Chin narrowly white; rest of under parts Lemon Chrome with a dark olivaceous wash on sides and flanks. Wings dark dusky brown; outer edges of remiges grayish, more olivaceous on tertials and inner secondaries; greater upper wing-coverts strongly edged with olivaceous; lesser wing-coverts olivaceous; inner vanes of remiges narrowly edged with whitish, less extensively distally towards the outermost; under wing-coverts and axillaries whitish. Tail dusky brown, paler below; outer margins of rectrices, except the outermost, olivaceous. Bill (in dried skin) brown; feet pale brown. Wing, 62 mm.; tail, 55; exposed culmen, 10; culmen from base, 14; tarsus, 19.

REMARKS: Sexes alike in color; males slightly larger. Size larger than *olivaceus*. Range of measurements: 10 adult males: wing, 59–62 (61.4) mm.; tail, 50–56 (54.1); culmen from base, 13.5–14 (13.9); three adult females: wing, 56–57 (56.6); tail, 49–52 (50.6); culmen from base, 13.5–14 (13.8). Measurements of *B. c. olivaceus:* seven adult males: wing, 54.5–61 (57.6); tail, 49.5–53 (51.3); culmen from base, 13–13.5 (13.1); five adult females: wing, 55–58 (55.9); tail, 49–52 (50.4); culmen from base, 13–13.5 (13.1).

Hellmayr,[1] with only three specimens from Mt. Roraima and one from British Guiana, found these different from *olivaceus*. He says: "Specimens from British Guiana [= Mt. Roraima, Venezuela] are again a little different, being slightly larger and a shade more brownish olive on the back." Our large series from Mt. Roraima makes it possible to confirm that the population of eastern Bolívar is different.

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[1] 1935, Catalogue of birds of the Americas, pt. 8, p. 501.

We have not seen the specimen from Annai, British Guiana, listed by Hellmayr, but as he mentioned no difference between it and his three from Mt. Roraima it may be presumed that it belongs to the new race.

SPECIMENS EXAMINED

B. c. roraimae.—VENEZUELA: Paulo, Roraima, 8 ♂ (including type), 1 ♀; Arabupú, 5 ♂, 3 ♂,[1] 1 ♀ (?), 2 ♀.[1] VENEZUELA[1]: Altiplanicie de Nuria, 2 ♂, 1 ♀, 2 (?); El Palmar, 1 ♂, 2 ♀; Cerro Tomasote, 3 ♀, 1 (?); Cerro Ptari-tepui, 1 ♀; La Paragua, 2 ♂, 2 (?); Cerro Tigre, 1 ♀, 1 (?).

B. c. olivaceus.—TRINIDAD: 7 ♂, 10 ♀, 1 (?). VENEZUELA: La Tigrera, 3 ♂; Campos Alegre Valley, 2 ♂, 2 ♀; San Antonio de Maturín, 4 ♂, 1 ♀; Quebrada Seca, 1 ♂, 1 ♀; Cocallar, 1 ♀; Cristóbal Colón, 8 ♂.

Myospiza aurifrons tenebrosa, new subspecies

TYPE: From San Carlos, Terr. Amazonas, Venezuela; altitude 180 meters. No. 41906, Phelps Collection, Caracas. Adult male, collected August 18, 1947, by Manuel Castro. (Type on deposit at the American Museum of Natural History.)

DIAGNOSIS: Differs from the known forms of *M. aurifrons* by being darker throughout; the central stripes of crown and back are blacker and broader and the edges darker; breast more strongly washed with gray; outer edges of remiges darker; sides and flanks washed with darker gray.

RANGE: Known from the junction of the Caño Casiquiare and Río Guainía down the Río Negro to El Carmen, near the Brazilian border.

DESCRIPTION OF TYPE: Feathers of crown blackish, narrowly edged with brownish gray, somewhat more yellowish on forehead; feathers of back with broad blackish streaks bordered with brownish, the feathers with broad olive gray edges; rump Mouse Gray × Hair Brown; upper tail-coverts darker and browner; supraloral stripe and lores Lemon Chrome continued as a duller and greener superciliary stripe; anterior malar region and slight subocular lunule yellowish; auricular region brownish gray with inconspicuous paler shaft streaks. Chin, throat, abdomen, and under tail-coverts white; breast washed with Pale Smoke Gray; sides and flanks darker, approaching Light Grayish Olive; thighs dull brownish exteriorly, whitish interiorly. Wings Fuscous, paler on under surface; remiges edged outwardly with dull olivaceous, more brownish on inner secondaries and tertials; upper wing-coverts edged with dull grayish; carpal margin broadly Pinard Yellow; under primary-coverts dark grayish; remaining under wing-coverts and axillaries yellowish white. Tail Fuscous, paler below; rectrices finely edged externally with gray. Maxilla (in life) "black"; mandible "gray"; feet "gray"; iris "brown." Wing, 58 mm.; tail, 42.5; exposed culmen, 11; culmen from base, 14; tarsus, 21.2.

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[1] Specimens in the Phelps Collection, Caracas, Venezuela.

REMARKS: Sexes alike. Size similar to *M. a. aurifrons.* Range of measurements: five adult males: wing, 53–60.5 (56.7) mm.; tail, 40–47 (43.5); culmen from base, 14–15 (14.3); four adult females: wing, 55–57 (55.5); tail, 39–44 (40.7); culmen from base, 13.2–15 (14.0). Measurements of *aurifrons* from Teffé: five adult males: wing, 58–60 (58.8); tail, 40.5–43 (41.5); culmen from base, 14–15 (14.5); five adult females: wing, 56–59 (57.6); tail, 39–44 (41.2); culmen from base, 14–15 (14.4).

The juvenile differs in having no yellow on head other than a faint indication on lores; breast streaked with dusky; bend of wing yellowish white; and tertials edged with rufous brown.

The species has been previously known from Venezuela only by the subspecies *apurensis* from the upper Apure Valley.

SPECIMENS EXAMINED

M. a. aurifrons.—BRAZIL: Piloto, Rio Negro, 1 ♀[1]; Santarem, 1 ♀; Faro, 1 ♂, 1 ♀; Santa Elena, 1 ♀; Arumanduba, 1 ♂; Porto Velho, 1 ♂, 2 ♀; Manaos, 3 ♂, Santo Isidoro, Teffé, 2 ♂, 3 ♀, 3 ♀ juv.; Boca Lago, Teffé, 4 ♂, 5 ♀, 2 ♀ juv. PERÚ: Mouth of Río Curaray, 2 ♂, 4 ♀. ECUADOR: Lower Río Suno, 1 ♂; Zamora, 5 ♂, 1 ♂ juv., 4 ♀, 1 ♀ juv. BOLIVIA: Todos Santos, 1 ♀; Tres Arroyos, 1 ♂; Yungas, 2 ♂, 1 ♀, 1 (?); Mapire, 1 ♂. COLOMBIA: Florencia, 3 ♂, 2 ♀; La Morelia, 2 ♂, 2 ♀, 2 (?) juv.

M. a. cherriei.—COLOMBIA: Villavicencio, 1 ♀ (type), 1 (?) juv.

M. a. tenebrosa.—VENEZUELA: Junction of Caño Casiquiare with Río Guainía, 2 ♂,[1] 1 ♂ juv., 1 ♀ juv., 2 (?) juv.; San Carlos,[1] 2 ♂ (including type), 3 ♀, 1 (?); El Carmen,[1] 1 ♂, 1 ♀.

M. a. apurensis.—VENEZUELA: Santo Domingo, 1 ♂ (type),[1] 1 ♂.

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[1] Specimens in the Phelps Collection, Caracas, Venezuela.

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NEW AFRICAN ANTS OF THE GENERA *CERAPACHYS*, *PHRYACACES*, AND *SIMOPONE*

BY NEAL ALBERT WEBER[1]

The genera *Cerapachys* and *Phryacaces* are included in the subfamily Cerapachyinae which is of particular interest in connecting the primitive subfamily Ponerinae with the specialized subfamily Dorylinae, the driver ants of the Old World and the army ants of the American tropics. The ants are uncommon outside Australia, and few species are known from Africa. The species of *Cerapachys* subgenus *Parasyscia* which is described below is the first of this particularly rare subgenus to be recognized from Africa. The genus *Simopone* has been thought to be allied with the Neotropical *Cylindromyrmex* in a tribe of Ponerinae, but perhaps should be placed in the Cerapachyinae. The *Simopone* worker has the body proportions of that of *Cerapachys* and of *Phryacaces*, being a stout, cylindrical ant with massive petiole and postpetiole, the latter sharply constricted from the gaster. It similarly has short, stout antennae, is heavily sculptured, and has a pilosity of long, fine hairs which do not conceal the integument. While *Simopone* in Africa appears to be arboreal, *Cerapachys* and *Phryacaces* in Africa are known only as terrestrial ants.

The ants were taken in Equatorial Africa by me as biologist to the Central African Expedition of the American Museum of Natural History, Dr. James L. Clark, Leader. Holotypes and cotypes are deposited in the collections of this museum.

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[1] Swarthmore College, Swarthmore Pennsylvania.

Cerapachys (Parasyscia) nitida, new species

WORKER: Length, extended, 3.3–3.4 mm.; of thorax 0.84 mm. Head in front view, excluding mandibles, one and one-fifth times longer than broad, occiput nearly straight and marginate in front, concave behind, the corners produced behind as rounded carinae; sides slightly convex, widest apart at the level with the posterior margin of the eyes; anterior clypeal margin convex; frontal lobes rounded, sub-vertical, not concealing antennal insertions, not appreciably prolonged posteriorly as carinae; eye small (about 0.1 mm.), feebly convex, situated very slightly closer to the anterior than to the posterior border of the head; antennal scrobes deep, becoming rapidly shallow posteriorly, bordered laterally by carinae of the cheeks which bear three or four tubercles on their crests, the most anterior of which extends beyond the sides of the head; antennae eleven-segmented; scapes extending farther back than the posterior margins of the eyes, stout and clavate; first funicular segment goblet shaped, second greatly compressed, three to nine gradually elongating, and terminal segment equal in length to the preceding seven; mandibles short, stout, convex, and with denticulate cutting margin.

Thorax in side view evenly convex above to the marginate epinotum, from above rectangular with convex anterior and slightly concave epinotal borders, less than twice as long as broad; epinotal angle and sides evenly carinate, no teeth, declivous surface plane. Petiole rectangular from above, about two-thirds as broad as postpetiole, about one and one-third times broader than long, sides feebly convex, anterior and posterior border nearly plane and carinate. Postpetiole from above about one and one-half times broader than long, broader behind than in front, sides feebly convex, posterior border straight. Gaster subovate with straight anterior border, first gastric segment much larger than the following segments taken together, pygidium flat and margined by short spines, sting long and stout. Legs short and stout, femora of middle and hind legs about 1.3 times longer than tibiae.

Shining, sparsely punctate. Head and thorax finely and evenly punctate, punctations of pedicel coarser and more close together, of gaster much finer and more widely spaced; appendages punctate. Pilosity of moderately abundant and short yellowish hairs, becoming more numerous posteriorly. Appendages sparsely pilose and with a scanty pubescence not obscuring integument.

Piceous, appendages a medium brown.

FEMALE (ALATE): Length, extended, 3.6 mm.; of the thorax (excluding neck) 1.03 mm.; of forewing 2.65 mm. Similar to the worker with the usual sexual differences. Head in front view, excluding mandibles, 1.15 times longer than broad at a level with the posterior margin of the eyes; eyes small (about 0.16 mm.), situated approximately in the middle of the head, ocelli in a close triangle near the occiput; mandibles short, stout, convex, finely denticulate; antennal scape short, clavate, terminal funicular segment over two-thirds the length of the preceding funicular segments taken together. Thorax convex above, impressed at the mesonotum and with marginate epinotum. Petiole marginate anteriorly and posteriorly; postpetiole 1.6 times longer than the petiole. Gaster with flattened pygidium margined by spines irregular in development and height, becoming larger posteriorly; sting long, stout, exserted; wings pale, with light brown stigma. Sculpturing, pilosity, and color as in the worker.

TYPES: Holotype and cotypes: Workers and alate females of one colony taken March 17, 1948, 10 miles east of Stanleyville, Belgian Congo. The ants were among humus and fallen leaves on top of an old fallen log in rain forest. They showed great reluctance to leave the moist litter with which they were gathered and remained in this for over 24 hours before time was available for examination. At this time, when removed, the ants crawled actively about, holding their antennae with about an 80° angle between them and directly in front of the head. The alates, which crawled actively about, did not attempt flight though apparently mature. In life the ants appeared black and shiny.

Since the other known species of *Cerapachys* in Africa have twelve-segmented antenna, the present species is easily distinguished on that basis alone. Aside from this character, it would run in Arnold's key to *cribrinodis* Emery, which is also larger (3.7–4 mm.), with larger eyes and with other differences. While of the habitus of *sudanensis* Weber, this has markedly larger eyes and is in other ways different.

Phryacaces braytoni, new species

WORKER: Extended length 2.8 mm.; of thorax 0.75 mm.

Head in front view, excluding mandibles, very slightly longer than broad between lateral eye margins, slightly broader in front than behind and broadest through the eyes, occipital margin straight, sides feebly convex; eyes 0.22 mm. in diameter, feebly convex, situated in front of the middle of the head; anterior clypeal margin truncate, the frontal carinae slightly exceeding it; mandibles short, stout, convex, with a series of minute denticles on the cutting margin; frontal carinae subvertical, distinctly separate from one another, anteriorly convex, antennal fossa margined laterally by a short carina which reaches the antero-medial border of the eye; antennal scape short, stout, feebly clavate, hardly reaching the posterior margin of the eye, antennae twelve-segmented, segments 5 to 12 gradually thickening and forming an indistinctly four-segmented club. Thorax in side view feebly and evenly convex with evenly concave epinotal declivity, from above rectangular with convex and feebly marginate anterior margin and straight but distinctly marginate epinotal angle. Petiole in side view with perpendicular anterior margin forming a right angle with the dorsal surface which latter forms a convexity with the steeply sloping posterior surface; from above transversely rectangular, about 0.6 times as long as broad, with sharply concave anterior margin forming acute angles with the feebly convex sides; these join the posterior rounded margin without forming teeth. Postpetiole in side view convex above, much thicker than the petiole and about as thick as the following segment, from above, about 1.3 times broader than the petiole, convex anteriorly and rounding laterally into the convex sides, posterior margin truncate. Gaster small and ovate, slightly broader than the postpetiole, sting exserted. Legs of moderate proportions and slender.

Shining, feebly sculptured, the head, thorax, and petiole with fine piligerous punctations and a faint vermiculation, the postpetiole densely punctate, gaster and appendages feebly punctate. Pilosity of moderately long, sparse, pale yellowish hairs which become more numerous on the gaster, and of a fine, oblique pubescence especially on the postpetiole, gaster, and appendages.

Color ferruginous except on the lower postpetiole and gaster which are blackish brown to black.

TYPES: Holotype and cotype: Two workers taken January 16, 1948, about 29 miles by trail southwest of Mtito Andei, Kenya. The ants were taken at the edge of a pool, containing several hippopotamuses, under a pile of lava rocks close to the origin of the stream forming it. One worker was first seen crawling over damp ground covered with short grass which was trampled by hippopotamuses, rhinoceroses, baboons, and other mammals. It crawled in typical cerapachyine fashion, beating antennae wasp-like, and walking close to the ground. Realizing the rarity of such ants, the party was persuaded to halt until I could find a second specimen which was eventually found nearby. The ants were thus not traveling in a file as such ants sometimes do.

The species, dedicated to my youthful companion, Brayton Wilbur, Jr., is distinctive in its small size, lack of sharp sculpturing, and gaster sharply contrasting in color with the rest of the body. The petiole lacks the teeth forming the posterolateral angles which most African species possess.

Phryacaces vespula, new species

WORKER: Length, extended, 3.4 mm.; of thorax (excluding neck) 1.1 mm. Head, excluding mandibles, slightly longer than broad, occipital margin feebly concave, corners rounded, sides convex with head broadest at a level with the posterior margin of the eyes, inferior posterior angles produced as small, rounded laminae which continued forward as gradually reducing carinae. Eyes elliptical, moderately convex, and of moderate size, situated near the middle of the head. Frontal carinae converging posteriorly and ending at a level about at that of the middle of the eyes, frontal lobes produced as subvertical, rounded, concave lamellae protruding slightly over the anterior clypeal margin. Carinae of cheeks produced above as a thick, flattened surface, divergent anteriorly and projecting as rounded teeth. Mandibles short, convex, and finely denticulate. Antennal scapes extending to a level with the posterior border of the eyes, clavate, bowed, funicular segments short and broad, terminating as a gradually developed four-segmented club.

Thorax in profile evenly convex, without trace of sutures; from above appearing rectangular with sides slightly impressed medially, anterior margin convex, and posterior or epinotal angle feebly concave, marginate and laterally produced as rounded angles rather than teeth. Petiole rectangular from above, one and one-half times broader than long, anterior margin feebly concave, sides slightly divergent posteriorly and convex, posterolateral angles produced as rounded teeth. Postpetiole slightly broader than petiole, squarish, with sides and anterior margin feebly convex, posterior margin truncate. First gastric segment broader than postpetiole with sides convex and anterior and posterior margins concave, segments 2–4 markedly smaller and everted, sting large and stout. Legs of moderate length and slenderness, hind coxae with a rounded lamella distally and posteriorly.

Shining, with coarse, piligerous punctations. Mandibles with scattered punctations, head from the margin of the eyes to the occiput more densely punctate, a smooth area median to each eye and at the sides of the head; dorsum of thorax with punctations tending to become striate-punctate anteriorly and posteriorly, the central area largely smooth, sides irregularly sculptured with a median smooth area, epinotal declivity finely striate; dorsum of petiole and postpetiole densely punctate, the punctations tending to become confluent; articulating surface between postpetiole and gaster finely and transversely striate; punctations of gaster markedly finer than those elsewhere and abundant; legs punctate.

Pilosity of long, fine, yellowish hairs, most abundant on the postpetiole and gaster, but not obscuring the integument. Pubescence of fine, reclinate, yellowish hairs most abundant distally on the appendages, but not so numerous as to conceal the shining integument.

Piceous, the color on the appendages gradually diluting to a medium brown distally.

HOLOTYPE: One worker taken February 17, 1948, in central Kavirondo, Kenya, at an altitude of nearly 5000 feet. A second worker belonging to the same colony was also taken.

Differing from a paratype and nidotype of *P. langi* Wheeler chiefly in size, sculpturing, and color. The size is slightly smaller, the head less abundantly and deeply punctate, the thorax and petiole above lack the deep, even rugosities of *langi*, the postpetiole is markedly less marginate in front, and the color of the appendages darker. The two, however, are closely related. *P. foreli* Santschi apparently has a thorax even more rugose than *langi*, while *P. braunsi* Emery is described as entirely and finely punctate.

The ants were taken at the side of a small stream as they foraged over exposed clay soil and short, green grass, wet from the dew of the early morning. When alarmed by my motions in capturing them the ants beat their antennae in front, wasp-like, so rapidly as to blur. The common ant here was *Myrmicaria eumenoides* Gerstaëcker.

What is probably the chief stridulating surface is well shown by the large, transversely ridged articulation between the postpetiole and gaster. The gastric segments are more flexible here than in many ants, and sounds are doubtless produced by rubbing one segment over the other.

Simopone wilburi, new species

WORKER: Length, extended, 5.4 mm., of thorax (excluding neck) 1.4 mm. Head, excluding mandibles, 1.4 times longer than broad back of eyes, occipital margin concave, sides concave, anterior clypeal margin truncate; eyes situated in the middle of the sides of the head, large, somewhat ovate, black, and convex; mandibles short, stout, convex, with broad cutting margin which is finely denticulate; sharply marginate antennal scrobes are deep at the antennal insertions and become shallow as they extend nearly to the anterior margin of the eyes; frontal carinae extend to a level with the anterior margin of the eyes, where they are low and divergent, extending anteriorly they become higher and terminate as low, evenly convex frontal lobes which conceal the antennal insertions only when the head is viewed from the front; below the scrobes are low, rounded genal carinae; antennal scapes stout and clavate, not reaching a level with the middle of the eyes; first funicular segment goblet shaped, second and third clearly broader than long, more distal segments gradually enlarging to an indistinct three- or four-segmented club, terminal three segments approximately equal in length to the preceding taken together. Thorax in side view evenly and slightly convex, the promesonotal suture very slightly indicated; from above, including epinotum, rectangular, anteriorly and posteriorly marginate, the anterior border feebly convex, the posterior epinotal border concave, over twice as long as broad, the sides feebly impressed and slightly broader through the meso-epinotum than through the pronotum; no epinotal teeth, the declivous surface flat, the lateral margins carinate. Petiole from above trapezoidal, corners angulate, broader behind than in front, slightly broader than long, anterior and posterior borders marginate and truncate, sides convex. Postpetiole longer and broader than petiole, longer than broad and with corners rounded instead of angulate. Gaster elongate with segments fully extended, pygidium not markedly depressed and bordered on each side with seven to nine acute, short spines, sting long and stout. Legs of moderate proportions and length.

Shining; head with scattered, large, shallow punctations, longitudinally striolate between the eyes and clypeus; thorax with similar scattered punctations, the sides with several smooth areas; petiole and postpetiole with similar, but more numerous and more evenly distributed punctations; gaster finely and shallowly punctate.

Pilosity of long, fine, yellowish, reclinate hairs most numerous on the pedicel and gaster, the gaster in addition near the apex with scattered, much longer hairs backwardly directed. Pubescence scattered and fine, most abundant on the appendages distally, but not obscuring the integument.

Piceous; mandibles, tip of gaster, and trochanters dark brown, antennae somewhat lighter brown, tibiae and tarsi brownish yellow.

HOLOTYPE: One worker taken February 24, 1948, about 17 miles north of Beni, eastern Belgian Congo. The locality is near the eastern edge of the Ituri part of the great Congo Forest. The ant was taken as it was rapidly crawling up a tree in dense shade at a height of about 6 feet. The species is evidently arboreal like *Simopone marleyi* Arnold, which was taken in hollow stems of a castor-oil plant in South Africa.

The species is near *S. schoutedeni* Santschi which is comparable in size, but this has, among other differences, more extended antennal scrobes, a rectangular instead of trapezoidal petiole with the corners less angulate, and finer punctation of the pedicel.

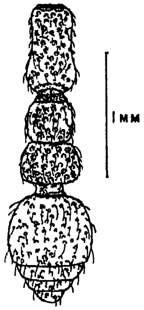
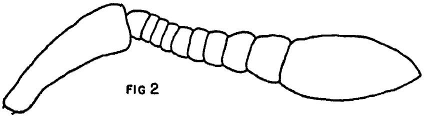


FIG 1



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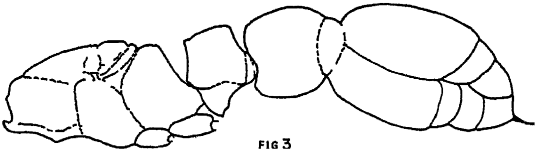

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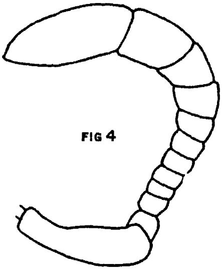

FIG 4

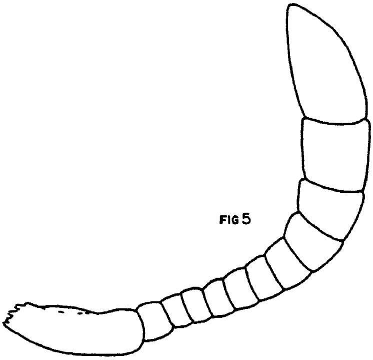

FIG 5

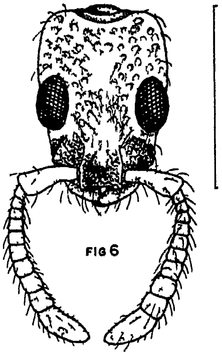

FIG 6

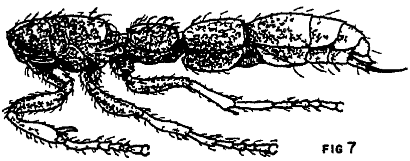

FIG 7

Fig. 1. Dorsal view of thorax and abdomen of worker of *Cerapachys* (*Parasyscia*) *nitida*, new species.

Fig. 2 Outline of worker antenna of *Cerapachys* (*Parasyscia*) *nitida*, new species.

Fig. 3. Lateral outline of female of *Cerapachys* (*Parasyscia*) *nitida*, new species.

Fig. 4. Outline of worker antenna of *Phryacaces braytoni*, new species.

Fig. 5. Outline of worker antenna of *Phryacaces vespula*, new species.

Fig. 6. Frontal view of head of worker of *Simopone wilburi*, new species.

Fig. 7. Lateral view of body and legs of worker of *Simopone wilburi*, new species.

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NOTES ON SOME HAWAIIAN PLECTOGNATH FISHES, INCLUDING A KEY TO THE SPECIES

BY EUGENIE CLARK[1]

Fishes of the Order Plectognathi, although economically of little significance, are of interest to the scientific investigator because of some of their unique anatomical features, concerned principally with the mechanisms employed by these fish for defense. Among them are the expansible stomach of the puffer fish, the erectile dermal spines of the porcupine fish, the trigger-like mechanism in the first dorsal fin of the balistid, and the rigid exoskeleton or carapace of the box fish.

These fishes form a large fraction of the piscine population in the coral reef waters of the Hawaiian Islands and constitute a small part of the fishing catch which is brought in daily to Kewalo Basin. Many of the specimens used in this present study were obtained from this source.

The flesh of some tetraodontids, diodontids, and ostraciids is reputed to be quite palatable. Even the scantily meated monacanthids and balistids are sold for food, although on the whole the plectognaths are not important food fish. On the contrary all the groups mentioned, even the ostraciids (Whitley, 1943; Schultz and Stern, 1948), should be eaten with extreme caution, if eaten at all, as they are noted for occasionally producing poisonous effects which are sometimes erratic in their appearance. The poison is known to attack the nervous system, causing violent gastric disturbances (Herre, 1924; Yudkin, 1944). Larsen (1939) reported three cases of tetraodon poisoning in Hawaii, two of which resulted in death. His studies with rats, guinea pigs, and cats showed that in these animals the immature and ripe ova of the Hawaiian plectognaths, *Tetraodon hispidus* and *T. meleagris*, are definitely poisonous.

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Quoy and Gaimard (1824) were the first to publish a record of plectognath fishes from Hawaii. In their account of the piscine collections made by the Royal French corvette "Uranie," in 1819, they listed 22 species of fish from Hawaii, three of which were the plectognath forms *Tetraodon meleagris*, *Canthidermis maculatus*, and *Cantherines sandwichiensis*.

In 1905, when Jordan and Evermann's comprehensive study of fishes of the Hawaiian Islands was published, keys were included to all the forms then reported. Since that time a number of synonymies and additions have been made, and many of the generic and specific names altered numerous times. Today some 41 species of Plectognathi are recognized from Hawaii. The purpose of this paper is to present an up-to-date key to these forms and to supplement the key with some notes on new collections examined by the writer while in Honolulu during the spring of 1947.

The members of the staff of the Bernice P. Bishop Museum offered friendly assistance during the course of this study, and I would like to extend my sincere thanks to them, especially to Dr. C. H. Edmonson who allowed me to examine the fish collection and who provided laboratory space and equipment. It is also a pleasure to acknowledge the assistance of Mr. Spencer Tinker of the Waikiki Aquarium, who was helpful in providing living specimens and materials used in making collections. Dr. Robert Hiatt of the University of Hawaii and Mr. Vernon Brock, Fisheries Director for the Territorial Board of Agriculture and Forestry, were most generous in supplying many specimens collected in the ocean area around Oahu during the previous year. Dr. Charles M. Breder, Jr., kindly read the manuscript.

BALISTIDAE

Balistes vidua, *B. bursa*, and *B. capistratus* were obtained in large numbers from fishing boats in Kewalo Basin along with occasional specimens of *Balistipus rectangulus*, *B. aculeatus*, and *Melichthys radula*.

Two adult females of what is designated in the key as *Canthidermis maculatus* (Bloch) were secured from the University of Hawaii's collection of fishes. One 258-mm. specimen was found in a collection of preserved fish obtained from Kewalo Basin fishing boats during the summer of 1946. It was said to have been caught on hook and line in deep water off Oahu. The tail was mutilated and first dorsal spine broken, but otherwise it was in good condition. The other, a 275-mm. specimen, was caught in a net by the Territory's fishery ship on June 15, 1947, and turned over to me the next day in excellent condition.

Specimens of the genus *Canthidermis* are reported rarely from Hawaii. Only seven records could be found in the literature, and there is much confusion as to the identification of these few Hawaiian specimens. They have been listed under the following specific names: *maculatus*, *angulosus*, *aureolus*, *oculatus*, and *rotundatus*. Fowler (1928) has kept *C. maculatus* (= *Balistes maculatus* of Bloch, 1786) distinct and synonymized the rest under *C. rotundatus* (= *Balistus rotundatus* of Marion de Procé, 1822). He mentions a number of differences in his descriptions of these two species, but on checking the literature they are found to be overlapping or, as in the case of his head measurement for *C. rotundatus* (2 3/5 to 2 2/3), apparently based on immature specimens. Bleeker's figure (1865) for a young specimen of *oculatus* conforms to this head measurement, but the adult *angulosus* figured in Jordan and Jordan (1922) measures well over three times in the standard length, falling into Fowler's measurement for *C. maculatus*.

The two specimens I obtained are apparently the same species and agree with the description (Jordan and Evermann, 1905) and figure (Jordan and Jordan, 1922) for *C. angulosus*. The somewhat variable characters are as follows:

	SPECIMEN 1	SPECIMEN 2
Standard length	258 mm [1]	275 mm
Second dorsal fin count	3 + 20	3 + 21
Anal fin count	1 + 19	3 + 19
Scales from gill opening to base of caudal	46[1]	52
Length of head in standard length	$3\,^1/_4$[1]	$3\,^1/_3$

MONACANTHIDAE

Monacanthus spilosoma and *Cantherines sandwichiensis* were the most common plectognaths brought in by fishermen at Kewalo Basin. At fish markets they are found among the small "trash" reef fishes sold for a few cents a pound.

Owing to the mutilated tail, these values may be slightly small.

Several specimens of large (about 340 mm.) *Alutera scripta* as well as numerous *M. spilosoma* and *C. sandwichiensis* were contained in the University's preserved collection made within the year preceding the spring of 1947.

OSTRACIIDAE

One specimen of *Ostracion diaphanus* and four *O. lentiginosus* were obtained from Kewalo Basin fishermen. They were both common in the recent collections of the University.

The length of the middorsal, preocular, and ventral spines of *O. diaphanus* appears inversely proportional to the size of the fish, being greatly exaggerated in very young specimens (16 to 20 mm.). Like the tail length of *Lactoria cornutus* (the older specimens have greatly elongated caudal fins) the length of the carapace spines in *O. diaphanus* is obviously a function of age and is not significant in species identification. The young specimens examined have four or five transverse series of scutes posterior to the dorsal fin, and the preocular spines are divergent. None, however, showed spines on the dorsolateral ridges as did the adults. In body outline the young closely resemble *Lactoria fornasini*. Since only small specimens (under 71 mm.) of *L. fornasini* have been found, it is possible that *L. fornasini* is the young of *L. diaphanus*. *L. fornasini* is separated from *L. diaphanus* on the basis that the preocular spines are parallel or divergent, the scutes behind dorsal fin are in three transverse series, and the dorsolateral ridges are absent.

Fraser-Brunner (1940) points out that there are striking sex differences in certain species of the ostraciid fishes which have caused them in some cases to be identified as separate species. He found this to be the case with *Ostracion lentiginosus* Bloch and Schneider and *O. sebae* Bleeker, the former being the female and the latter the male of the same species. We can now designate the species as *O. lentiginosus*, since Bloch and Schneider's description (1801) precedes that of Bleeker (1851) for *O. sebae.*

TETRAODONTIDAE

One specimen of *Tetraodon meleagris* and a number of *T. hispidus* were in the University's recent collection. The writer obtained two specimens of *T. hispidus* in Kaneohe Bay and many from Kewalo Basin fishermen. *T. hispidus* appears to be the most common puffer fish of the Hawaiian Islands. Young preserved specimens (under 30 mm.) do not show spots on dorsal and lateral surfaces but have conspicuous lines on belly.

CANTHIGASTERIDAE

The writer found the Canthigasteridae to be the most difficult family of Hawaiian plectognaths to identify. There is only one genus known, and all the species are very similar in form. They probably do not get much larger than 160 mm. The preserved material varies in outline owing to the different stages of inflation at which the specimens were "fixed" when first preserved, but basically there is little difference in their forms.

The color patterns and the distribution of prickles have tremendous individual variation. In the past, taxonomists who based species differences mainly on these apparently genetic or perhaps age or sex characters have split up this group into a number of species which are not valid.

All of the canthigasterids have spotting to some degree. In *C. jactator* and *C. margaritatus* the spots are large, conspicuous, and evenly cover most of the body, whereas in *C. amboinensis* and *C. rivulatus* the spotting is smaller, less conspicuous, and unevenly distributed. Pietschmann (1938), however, describes a specimen of what appears to be *C. amboinensis* in most aspects but which has large ocellated spots evenly distributed over the body.

In most canthigasterids there is a tendency for the spots to become closely packed on some parts of the body, often fusing to form solid areas or definite patterns of lines. In *C. rivulatus* some individuals have one or two broad horizontal bands on the sides of the body while in others the "bands" are resolved into spots. Even the conspicuous and usually radiating lines around the eyes of the canthigasterids are often found, in some individuals, to be somewhat broken down into discontinuous lines or spots.

In *C. cinctus* the broad saddle marks on the dorsal region are a fairly consistent and reliable pattern for species identification. Bleeker's figure (1865), however, shows these marks fused together to form a large, dark, dorsal area which breaks up into bands only as it descends laterally.

It is obvious that a great deal of material must be collected and studied before the proper identification of Hawaiian canthigasterids can be understood. Although the descriptions in the literature have been studied, the key to the Canthigasteridae presented in this paper is based on the examination of comparatively few specimens.

The writer found no canthigasterids in the University's recent collections, although a fresh adult male of *C. cinctus* and one of *C. rivulatus* were obtained from Kewalo Basin fishermen on May 14 and May 29, respectively. The following color notes were taken on the fresh specimens:

Canthigaster cinctus. Standard length 101 mm.; D 9; A 8. Base color gray blue with four wide brown saddle marks, the first above the eye and the last extending out along the dorsal margin of the caudal fin. The ventral margin of the caudal fin is also brown. Outside the brown areas, the body is speckled with bright yellow spots of various sizes, blending together in the belly region to form a solid, slightly paler yellow area. The spots do not blend together to form even a suggestion of radiating lines around the eyes. The iris is pale blue with brighter blue and a few yellow spots. Dorsal and caudal fins are pale yellow; other fins are colorless.

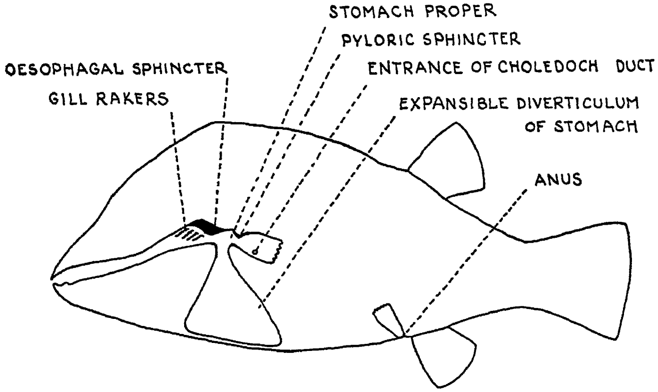

FIG. 1 Median sagittal section of *Canthigaster cinctus* showing inflating mechanism in the relaxed state.

Canthigaster rivulatus. Standard length 104 mm.; D 9; A 9. Belly light with a purple midventral line. Sides irregularly spotted with purple and a few bright yellow spots encircled with purple blending into a pattern of purple lines on the head, back, and caudal region. A bright yellow rim is present around the anterodorsal margin of gill opening. The iris is pale yellow. The dorsal and anal fins each have five yellow lines parallel to their bases. Caudal region with irregular purple and yellow lines horizontal on penduncle, curving onto more of a vertical plane on the caudal fin. Prickles on belly are a bright yellow. Pectoral fins are colorless.

The inflatable stomach of the tetraodontids and diodontids has been most recently discussed by Breder and Clark (1947). The inflating mechanism of the canthigasterids is essentially the same. (Fig. 1.) The oesophageal and pyloric sphincters hold the fluid gulped in by the mouth in the highly expansible stomach. The stomach is attached ventrally to the body wall, similarly to the condition in the tetraodontids. There does not appear to be any line of separation between the stomach proper and the expansible ventral diverticulum. The length of the alimentary canal from mouth to anus is about two and one half times the standard length. The parietal peritoneum posterior to the pyloric sphincter is thick and non-expansible and contains the rest of the viscera.

DIODONTIDAE

One specimen of *Diodon holacanthus* was found in the University's recent collection, and two specimens of *Chilomycterus affinis* were obtained from fishermen at Kewalo Basin.

MOLIDAE

The three species of this family have been reported from the waters of Hawaii. *Ranzania truncata* is not known to attain the gigantic proportions of *Mola mola* and *Mola lanceolatus*, records for both of which exceed 10 feet, but the 3- to 4-foot adults still exceed those of any of the other families of the Plectognathi.

The writer was unable to examine any recently collected specimens of this family.

OTHER PLECTOGNATH FAMILIES

The other two families in this order are not known from the waters of the Hawaiian archipelago, although it is possible that they inhabit the area but have not yet been reported. *Triodon bursarius* Cuvier, the single species of the family Triodontidae, is a rarely found form. The place nearest to Hawaii from which it has been reported is the Philippines (Herre, 1925), but it is not improbable that its range extends to Hawaii as does that of many of the Philippine plectognath species. The family Triacanthidae is represented by five species in Oceania (Fowler, 1928), none of which has yet been reported from Hawaii. Like *Triodon*, however, these deep sea triacanthids may well live in the inadequately studied, off-shore waters of Hawaii.

EXPLANATION OF THE KEY

The following key covers all the distinguishable species of the plectognath fishes that the writer could find listed from the waters of the Hawaiian archipelago. It is largely artificial, being based entirely on external and readily discernible features of the fish. It is workable for preserved as well as fresh material. In most cases the generic names used are those given by Fraser-Brunner, who bases his nomenclature on relationships determined by internal as well as external anatomical studies of the genera of the Plectognathi.

The outline drawings at the end of the key (figs. 2 to 9) are diagrammatic and for the purpose of emphasizing most of the characters used in the key and to show general differences and similarities in the forms of the various species. The only color patterns indicated in the figures are those that persist after the specimen has been preserved. Individual drawings have been modified from one or, more often, several figures, plates, and photographs in the literature, and a few are original. Wherever possible, they have been checked with actual specimens. The references consulted in making the key and illustrations are listed in the bibliography.

Starred species are rare in Hawaii and known only from one or a few records.

KEY TO THE SPECIES OF HAWAIIAN PLECTOGNATHI

A. Jaws with distinct teeth.
  B. Spinous dorsal fin present; body with scales or movable plates.
    C. First dorsal fin composed of 3, rarely 2, spines; scales comparatively large, rough, bony, in a regular series forming a coat of mail; all soft fins with branched rays............Balistidae
    CC. First dorsal fin of one spine with minute rudiment at its base; scales minute, not bony, the edges spinescent, giving the body a rough velvety surface; scales not in a noticeably regular series, rarely in contact; soft dorsal, anal, and pectoral fins with unbranched rays......................Monacanthidae
  BB. Spinous dorsal fin absent; body encased in an immovable carapace of hexagonal plates, only the jaws, bases of fins, and tail being free and covered by smooth skin......................Ostraciidae

AA. Jaws without distinct teeth, instead, a beak-like structure, with or without a median suture, is present in each jaw; spinous dorsal fin absent.

D. Caudal region normally developed with a caudal peduncle; belly inflatable.

E. Modified beak-like structure of upper and lower jaws each divided by a median suture.

F. One or two lateral lines, not always evident; back broadly rounded; nostrils well developed.....Tetraodontidae

FF. No lateral lines; back in most cases sharply ridged; nostrils obsolete or very small..............Canthigasteridae

EE. Modified beak-like structure of upper and lower jaws each undivided; body covered with deeply rooted spines..Diodontidae

DD. Body truncated behind dorsal and anal fins; without caudal peduncle and with caudal region aborted; jaws without median suture..... ....Molidae

Balistidae

A. Enlarged scales or osseous plates developed behind gill opening.

B. Preocular groove below nostril.

C. Teeth uneven, more or less deeply notched, not incisor-like.

D. Head entirely scaled up to lips.

E. Distance from anterior bases of dorsal and anal fins equal or less than distance from snout to first dorsal spine.

F. Scales from behind gill opening to tail with stout spines forming elevated lines which cover half of body.................*Balistes bursa* Schneider

FF. Elevated lines covering less than one-third of body and composed of small spines............ ....*Balistes capistratus* Shaw

EE. Distance from anterior bases of dorsal and anal fins greater than distance from snout to first dorsal spine.

G. Caudal fin pale, much lighter in color than body ....*Balistes vidua* Richardson

GG. Caudal fin dusky or dark, about same shade as body.................................... *Balistes nycteris* (Jordan and Evermann)*

DD. Snout with large naked area; cheek scales reduced to five or six widely spaced rows of tubercles.................. ....*Balistes fuscus* Schneider

CC. At least two middle teeth of upper and lower jaws even and incisor-like; body and fins dark; a pale line at base of dorsal and anal fins.....................*Melichthys buniva* (Lacépède)

BB. Preocular groove absent.

H. A broad black band on side extending from eye to base of anal fin where it is wider than half the length of the anal fin........ ....*Balistipus rectangulus* (Schneider)

HH. No broad black band on side.

I. About four diagonal stripes from middle of trunk to anal fin.. ....*Balistipus aculeatus* (Linné)

II. Body covered with diagonal stripes..*Balistipus undulatus* (Mungo Park)

AA. Gill opening with ordinary scales behind it; preocular groove present.

J. Chin projecting; cheek with three to five narrow parallel grooves; dorsal spines two.................*Xanthichthys ringens* (Linné)

JJ. Chin not projecting; cheek without grooves; dorsal spines three.......................................*Canthidermis maculatus* (Bloch)[1]

MONACANTHIDAE

A. Dorsal and anal fins each with less than 45 rays; pubic bone with a spine at its tip.

B. Body without spots and without a pattern of lines on side of head.

C. Eye large, wider than gill opening; pelvic spine well formed; lower jaw protruding noticeably...*Paramonacanthus garretti* Fowler*

CC. Eye moderate, less than gill opening; pelvic spine short; lower jaw not protruding noticeably...*Cantherines sandwichiensis* (Quoy and Gaimard)

BB. Body with spots and/or with a pattern of lines on head.

D. Pelvic spine jointed, movable...*Monacanthus spilosoma* Lay and Bennett

DD. Pelvic spine immovable.

E. Body conspicuously spotted; lacking a pattern of lines on head...................*Cantherines howensis* (Ogilby)*

EE. Body weakly spotted; having a pattern of lines on side of head....................*Cantherines pardalis* (Rüppell)

AA. Dorsal and anal fins each with more than 45 rays; pelvic spine lacking.

F. Caudal fin nearly truncate, shorter than head; snout convex..*Alutera monoceros* (Linné)*

FF. Caudal fin with rounded angles, longer than head; snout concave..*Alutera scripta* (Osbeck)

OSTRACIIDAE

A. Carapace with no midventral keel and closed behind dorsal and anal fin.

B. Carapace without spines.

C. Ventral surface convex; body heavily and almost completely spotted...........*Ostracion lentiginosus* Bloch and Schneider[2]

CC. Ventral surface slightly concave; spotting mostly confined to dorsal area.............................*Ostracion cubicus* Linné*

BB. Carapace with 2 preocular spines and 2 spines terminating ventral keels.

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[1] This includes *C. rotundatus* (Marion de Procé) in Fowler (1928). On the basis of rather intensive examination of the literature and the limited material available for inspection, no reliable differences between *C. maculatus* and *C. rotundatus* could be found and therefore they are listed as the same species in this paper.

[2] This includes *O. sebae* Bleeker which has been shown to be the male of *O. lentiginosus* by Fraser-Brunner (1940).

D. Dorsal surface with a large median spine.
  E. Small spines on dorsolateral crest posterior to orbit.......... .... *Lactoria diaphanus* (Schneider)
  EE. No spines on dorsolateral crest posterior to orbit............. .... *Lactoria fornasini* (Bianconi)*
DD. Dorsal surface without a large median spine.................... .... *Lactoria cornutus* (Linné)*
AA. Carapace with a midventral keel and open behind dorsal and anal fin...... .... *Aracana aculeata* (Houttuyn)*

TETRAODONTIDAE

A. A ventrolateral ridge on each side of caudal peduncle.
  B. Erectile small spines covering most of body; dorsal rays 8............. .... *Lagocephalus hypselogenion* (Bleeker)
  BB. Erectile spines confined to inflatable abdomen; dorsal rays 12 to 14 .. .. *Lagocephalus lagocephalus* (Linné)*
AA. Caudal peduncle lacking ventrolateral ridges.
  C. Skin in most cases entirely smooth, free from spines; body with no spotting or other conspicuous patterns......................... .... *Spheroides cutaneous* (Günther)*
  CC. Skin with many fine, setae-like spines; body spotted.
    D. Dorsal region of body with conspicuous and regularly spaced light spots.
      E. Body almost completely covered with small whitish spots... .... *Tetraodon meleagris* Schneider
      EE. Spotting does not extend over inflatable abdomen.......... .... *Tetraodon hispidus* Linné
    DD. Spotting dark and irregularly spaced........................ .... *Tetraodon nigropunctatus* Bloch and Schneider*

CANTHIGASTERIDAE

A. No broad, dark, saddle marks across back.
  B. Dorsal fin count 11 to 13...... *Canthigaster amboinensis* (Bleeker)[1]
  BB. Dorsal fin count 10 or less.
    C. Body with large, conspicuous, light spots.
      D. Caudal fin spotted.. *Canthigaster margaritatus* (Rüppell)*

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[1] The single Hawaiian record for *C. striolatus* (Quoy and Gaimard) reported from Maui by Fowler (1928) is apparently a specimen of *C. amboinensis*. Miss Myvanwy M. Dick of the Museum of Comparative Zoölogy at Harvard was kind enough to send the original specimen (M.C.Z. No. 31181) and, on checking the measurements, I found that fin ray counts (D 1 + 12, A 1 + 10) and, markings (particularly the dark bases of the dorsal and anal fins) were in accord with those given by Jordan and Evermann for *C. oahuensis* (Jenkins) and *C. psegma* Jordan and Evermann, both of which I believe Fowler (1928) is correct in synonymizing under *C. ambionensis*.

Pietschmann's single record for *C. polyophthalmus* (1938) is, for the purposes of this key, considered as belonging to *C. amboinensis* although, as Pietschmann points out, a greater amount of material is needed before its identification can be established.

DD. Caudal fin without spotting .... *Canthigaster jactator* (Jenkins)*[1]

CC. Body without large spots; usually with a dark band on side, extending from upper margin of gill opening to upper caudal base .... *Canthigaster rivulatus* (Schlegel)

AA. Three or four broad, dark, saddle marks across back .... *Canthigaster cinctus* (Richardson)

DIODONTIDAE

A. Dermal ossifications mostly two rooted; spines rather slender and erectile.

B. Frontal spines not longer than postpectoral spines .... *Diodon hystrix* Linné[2]

BB. Frontal spines long, usually longer than postpectoral spines, about twice as long as eye in adult........*Diodon holacanthus* Linné[2]

AA Dermal ossifications mostly three-rooted, each with a short, stout, immovable spine .... *Chilomycteris affinis* Gunther

MOLIDAE

A. Body oblong, depth more than two times in length; skin smooth, tesselated with small hexagonal plates; gill rakers free .... *Ranzania truncata* (Gmelin)

AA. Body roundish, depth less than two times in length; skin thick and rough, without hexagonal plates; gill rakers concealed in thick skin.

B. Caudal region rounded .... *Mola mola* (Linné)

BB. Caudal region ending in a median fleshy flap .... *Mola lanceolatus* (Liénard)

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[1] Pietschmann suggests that this form also may prove to belong to the widely distributed species *C. amboinensis*.

[2] The difference in the length of the frontal spines between *D. hystrix* and *D. holacanthus* apparently varies and is not a well-defined character. It may be possible that *D. hystrix* and *D. holacanthus* are the same species. (Evermann and Marsh, 1902; Nichols and Murphy, 1944.)

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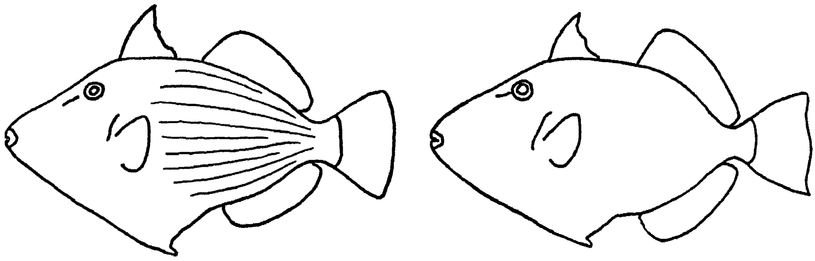
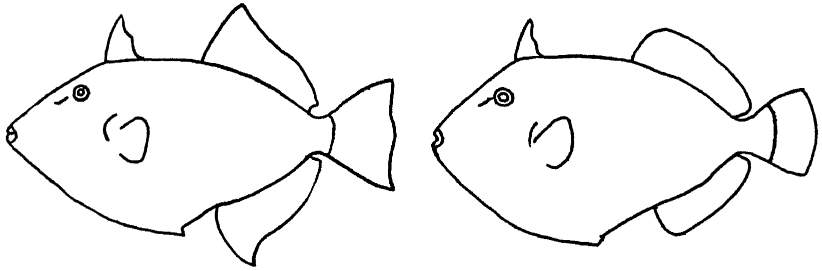
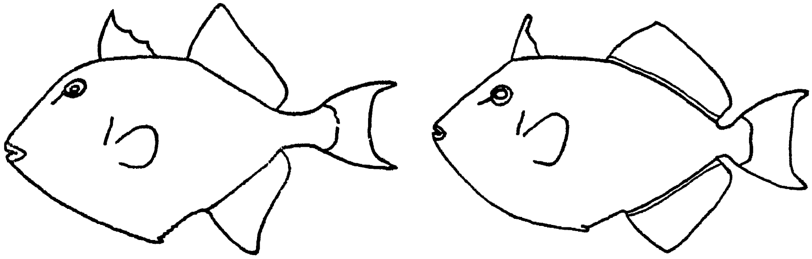


BALISTES BURSA   BALISTES CAPISTRATUS

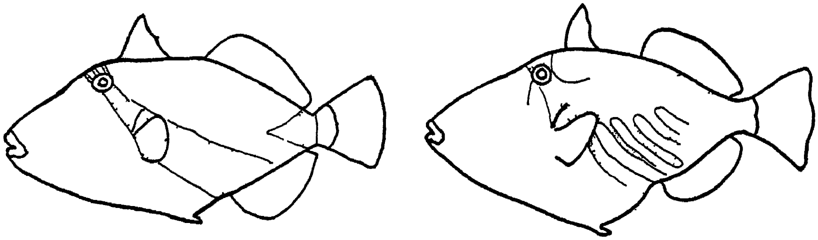


BALISTES VIDUA   BALISTES NYCTERIS

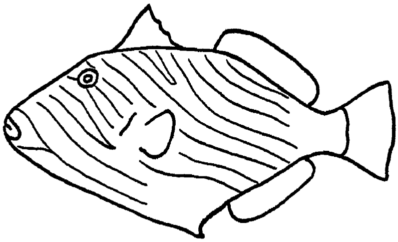


BALISTES FUSCUS   MELICHTHYS BUNIVA

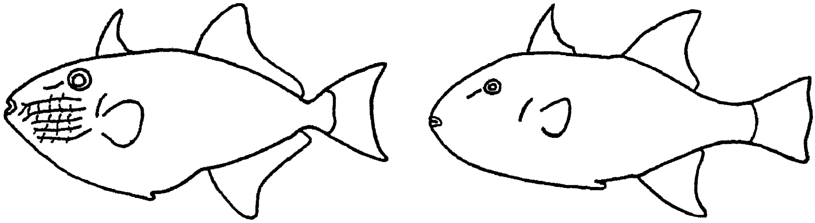
FIG. 2. Species of the family Balistidae.



BALISTIPUS RECTANGULUS BALISTIPUS ACULEATUS



BALISTIPUS UNDULATUS



XANTHICHTHYS RINGENS CANTHIDERMIS MACULATUS

FIG. 3. Species of the family Balistidae (concluded).

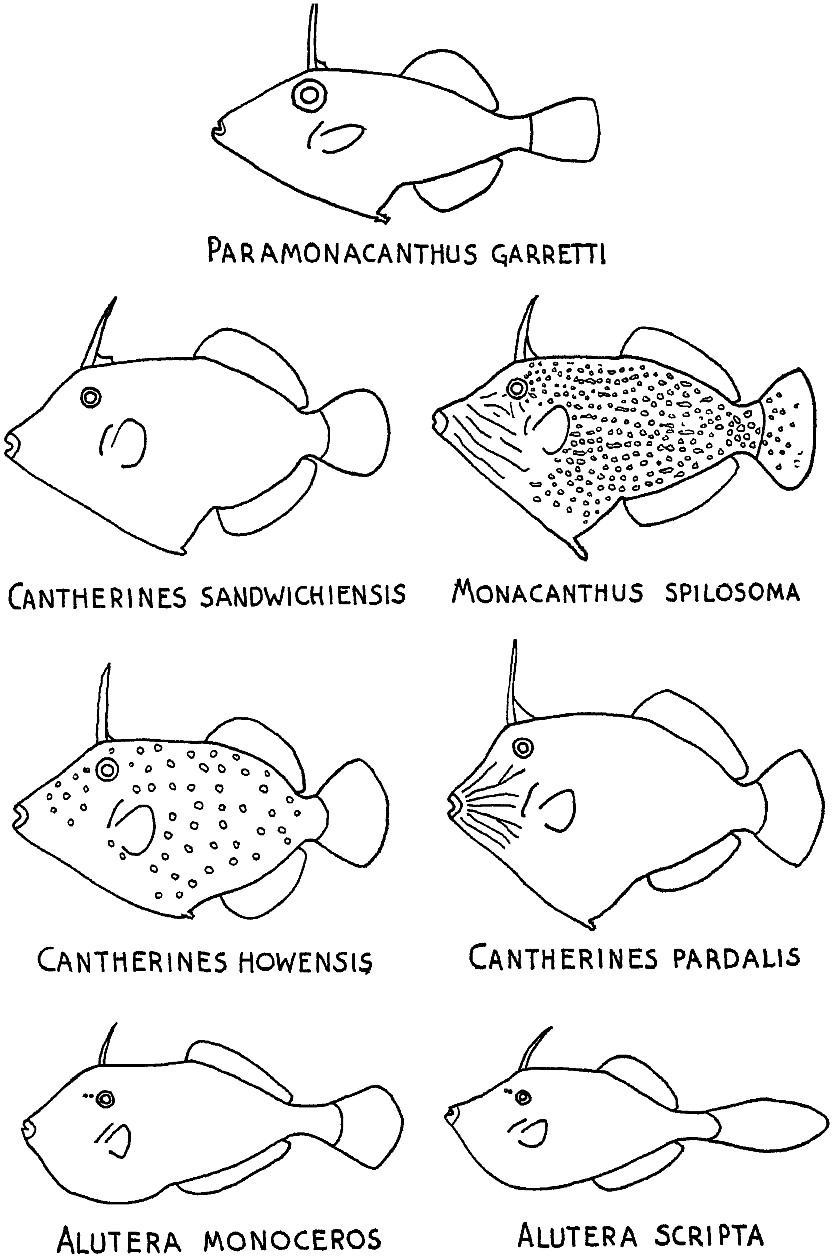
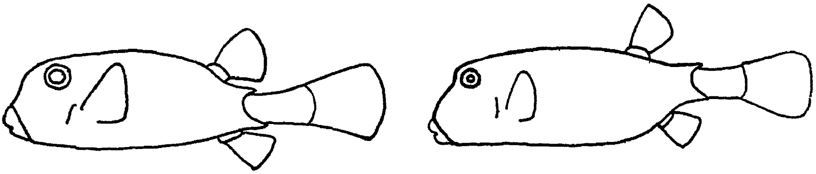
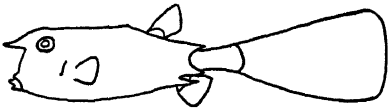


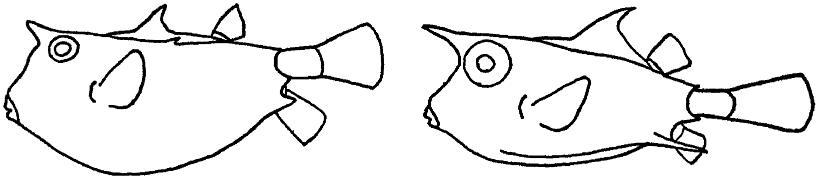
FIG. 4. Species of the family Monacanthidae.



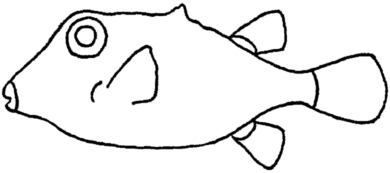
OSTRACION LENTIGINOSUS OSTRACION CUBICUS



LACTORIA CORNUTUS



LACTORIA DIAPHANUS LACTORIA FORNASINI



ARACANA ACULEATA

FIG. 5. Species of the family Ostraciidae.

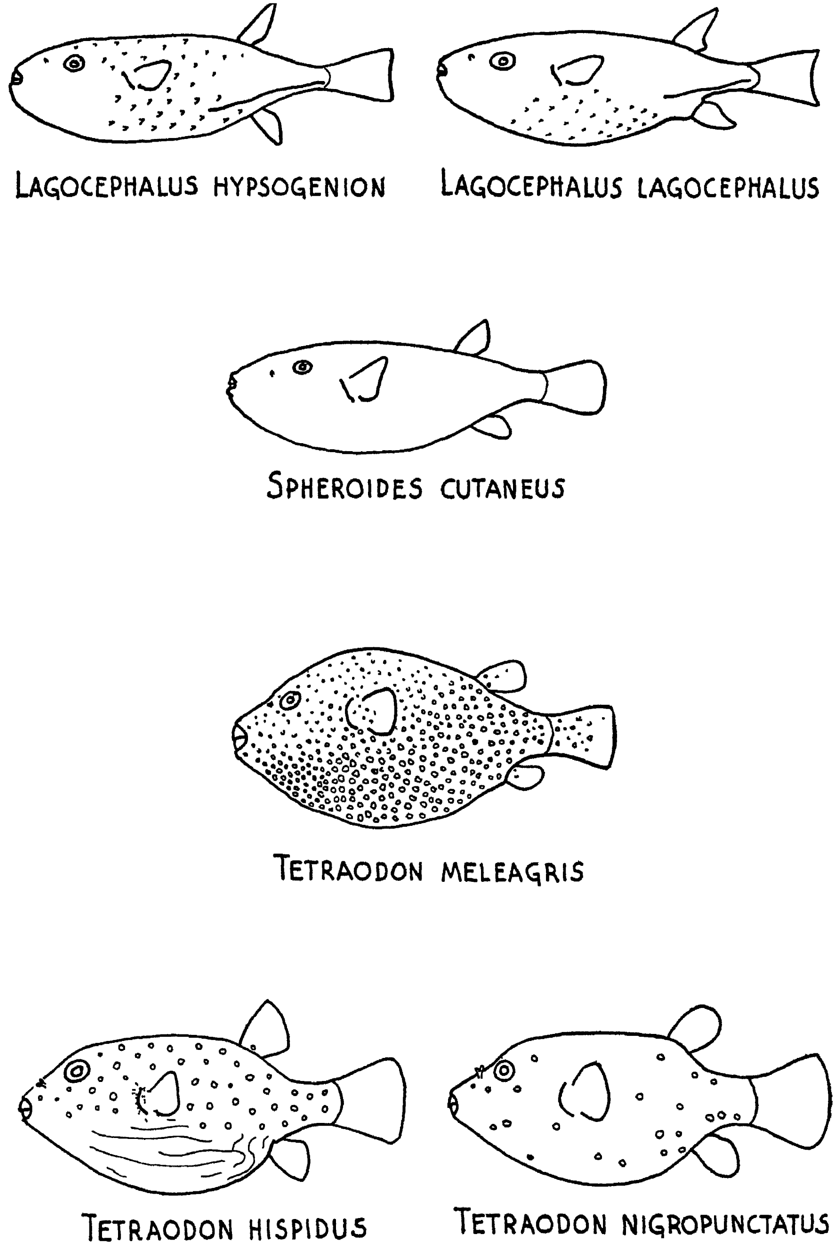
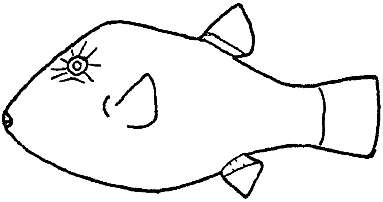
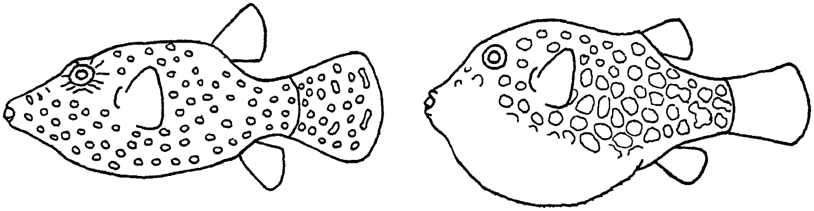


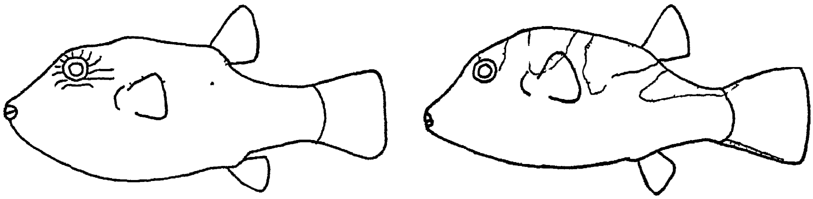
FIG. 6. Species of the family Tetraodontidae.



CANTHIGASTER AMBOINENSIS



CANTHIGASTER MARGARITATUS CANTHIGASTER JACTATOR



CANTHIGASTER RIVULATUS CANTHIGASTER CINCTUS

FIG. 7. Species of the family Canthigasteridae

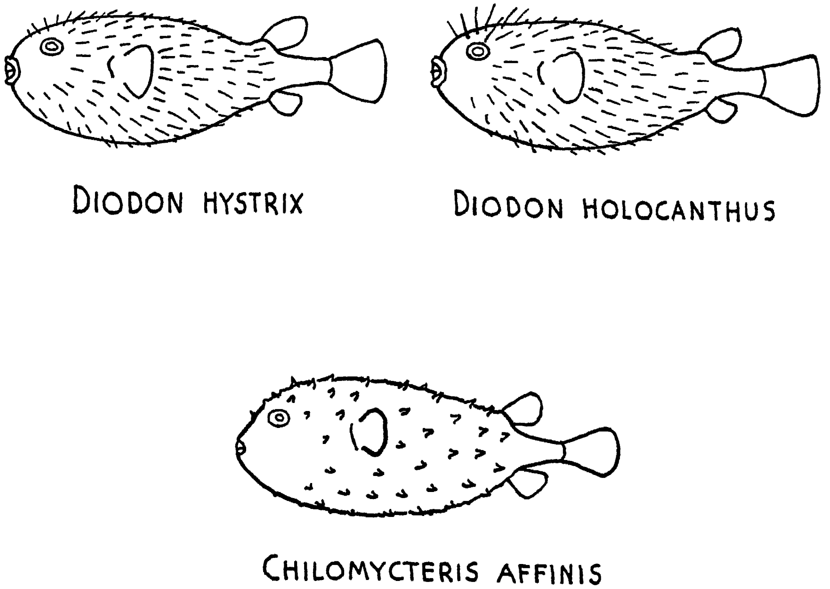
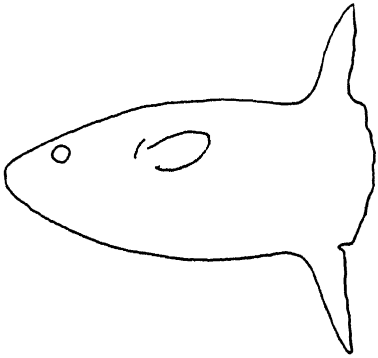
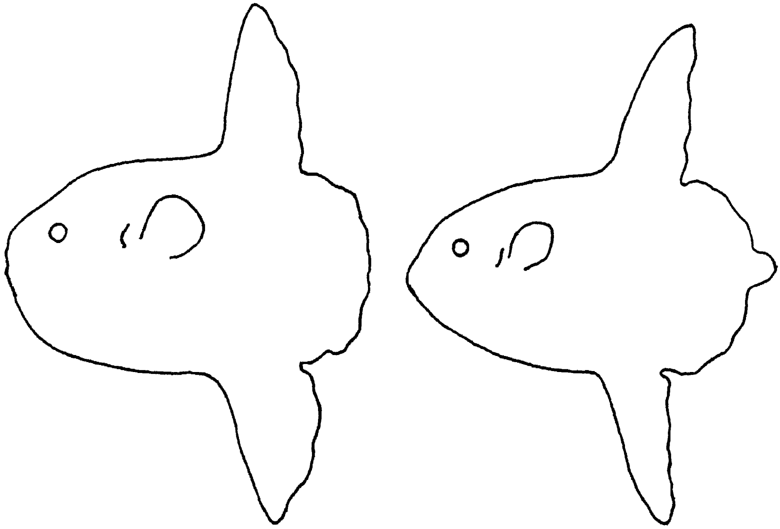


FIG. 8. Species of the family Diodontidae.



RANZANIA TRUNCATA



MOLA MOLA

MOLA LANCEOLATUS

FIG. 9. Species of the family Molidae.

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NEW PONERINE ANTS FROM EQUATORIAL AFRICA

BY NEAL ALBERT WEBER[1]

Descriptions of new species in the genera *Discothyrea*, *Probolomyrmex*, *Centromyrmex*, and *Asphinctopone* are presented in the present paper. They are rare, archaic relicts of interest to the student of zoogeography, while the blind *Centromyrmex* has striking adaptations for locomotion in subterranean termite nests and for preying on these insects. The genera have not previously been taken outside of coastal west Africa or south Africa, and the present records extend the range markedly east or north to indicate that the species represent remnants of an ancient continental distribution.

The genus *Discothyrea* has a tropicopolitan distribution and includes New Zealand, which must have acquired it before or in the Mesozoic. The genus *Probolomyrmex*, in the same tribe, Proceratiini, has hitherto been known from a species represented by west and south African specimens, a species in Java, one in Bolivia, and two in Panama The genus *Centromyrmex*, of the tribe Ponerini, is known from a species in Rhodesia, Angola, and Portuguese East Africa, and a second species from Cameroon as well as from the Neotropical and Indo-Malayan regions. The new species, like the Indo-Malayan *feae* Emery, is probably an obligatory predator on termites. The worker was helpless when exposed to the light and seemed incapable of locomotion on the ground The genus *Asphinctopone*, of the tribe Ponerini, has hitherto been known from one worker taken in Nigeria in 1912. The finding of a second specimen in east central French Equatorial Africa confirms the generic diagnosis and adds a distinct second species.

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[1] Swarthmore College, Swarthmore, Pennsylvania.

The ants were collected less than 5 degrees from the Equator on the Central African Expedition of the American Museum of Natural History, Dr. James L. Clark, Leader, by me as the expedition biologist. The holotypes are deposited in the collections of this museum.

Discothyrea patrizzii, new species

FEMALE (DEALATE): Length 1.7 mm., of thorax 0.52 mm. Head in front view, excluding mandibles, one and one-fifth times longer than broad back of eyes; occipital margin truncate, corners broadly rounded, sides feebly convex and converging slightly anteriorly, anterior clypeal margin produced as a broadly convex lobe over the bases of the mandibles; eyes blackish, about 0.09 mm. in diameter, convex, situated closer to the mandibular bases than their diameters; ocelli large and prominent; frontal carinae fused and vertical, produced as a semicircular lobe; mandibles short, stout, and convex, with a single long, acute apical tooth and a straight, seemingly minutely denticulate, cutting margin; antennae eight-segmented, scapes as usually held attain a level with the middle of the eyes, terminal funicular segment 0.19 by 0.11 mm.; one and two-thirds longer than the remainder of the funicular segments taken together, the entire funiculus 0.34 mm. long and slightly shorter than the scape. Thorax from above with pronotum evenly convex in front, epinotal angles feebly tuberculate; in side view with evenly convex pronotum passing posteriorly into a plane remainder, the epinotal declivity concave. Petiole in side view with high scale convex in front, concave behind, ventral surface produced in a U-shaped lamella. Gaster from above with only the first and second segments visible, anterior margin truncate, sides subparallel and feebly convex, posterior margin evenly rounded; sting stout and exserted from completely retracted terminal segments. Legs slender and of moderate proportions.

Dull, densely punctate, producing a coriaceous effect which in strong light is sub-lucid. Pilosity consisting solely of a minute, short, appressed pubescence generally distributed over the body.

Yellowish brown, margins of the segments darker, ocelli and eyes on separate blackish spots.

WORKER: Length extended 1.6 mm., of thorax 0.45 mm. Head in front view, excluding mandibles, one and one-third times longer than broad, occipital margin truncate, angles broadly rounded, sides convex and converging slightly to the clypeus which is produced anteriorly as a broadly convex lobe over the mandibles; eyes blackish, about 0.04 mm. in diameter, situated less than two of their diameters from the bases of the mandibles; antennae short and stout, scape clavate, terminal segment of funiculus 0.20 by 0.11 mm. and longer than the preceding funicular segments taken together; frontal carinae fused and vertical, produced as a convex lobe; mandibles short, stout, convex. Thorax in side view evenly convex above, angulate at the epinotum, with feebly concave declivous surface; viewed from above with straight sides converging behind from the evenly convex anterior pronotal margin, epinotum angulate at the corners and slightly concave between. Petiolar scale in side view thick, convex anteriorly, ventral surface produced in an evenly convex lobe directed slightly forward; viewed from above transversely rectangular, sides rounded as even convexities converging forward, so broader behind than in front, approximately 0.19 by 0.09 mm.

Sculpturing, pilosity, and color as in the female.

HOLOTYPE: One female taken February 5, 1948, in approximately latitude 01° 38′ S., longitude 35° 17′ E., Kenya. The ant came from the floor cover of leaves and humus of a densely wooded donga or ravine of the high (5500–5800 feet) east African plains.

ERGATOTYPE: One worker taken in 1945 in Nairobi, Kenya, by Saverio Patrizzi.

The eight-segmented antennae separate this species readily from the nine-segmented *hewitti* Arnold, *oculata* Emery, and *traegaordhi* Emery, as does also the smaller size. The lobate fused frontal carinae of *hewitti* are produced as a triangular plate.

Probolomyrmex parvus, new species

FEMALE (DEALATE): Length extended 2.06 mm.; of thorax 0.67 mm. Head in front view, including the scarcely visible mandibles, one and one-third times longer than broad, occipital margin truncate, corners broadly rounded, sides subparallel, feebly convex, clypeus produced anteriorly as a convex lobe beneath which the external margin of the mandibles is barely visible; ocelli prominent; eyes convex, situated in front of middle of head; frontal carinae fused and produced as a vertical, rounded, nearly right-angled lobe; mandibles short, stout, convex; antennal scapes short, stout, clavate, slightly bowed out, attaining a level just behind the posterior margin of the eyes, funicular segments 2–11 gradually increasing in size and forming an indistinctly four-segmented club. Thorax from above broadest through the pronotum which is convex anteriorly, the epinotum with feebly convex sides and sharply emarginate posteriorly; thorax in side view with pronotum rising sharply to a small convexity forming an angle with the general broadly convex dorsal surface, epinotum with short, feebly convex basal surface forming a rounded, obtuse angle with the angulately concave declivous surface. Petiole not pedunculate in front and forming a peduncle behind the node formed in part by the articulation with the gaster, from above with node convex in front and marginately concave behind, in side view with node rising in an even convexity to the posterior surface and making an acute angle with it, descending posteriorly in a concavity, ventral surface with a large angulate lobe which is straight anteriorly and posteriorly. Gaster from above with first segment smaller than the second and constricted from it, narrowed to the truncate anterior margin; segments following the second not visible from above, sting not exserted in the specimen. Legs moderately long and slender.

Sub-lucid, finely and densely punctate with a coriaceous appearance. Pilosity consisting of a dense, pale yellow, appressed pubescence evenly covering the body.

Body a dull, pale brown with infuscated sutures, legs more yellowish brown.

HOLOTYPE: One worker taken February 17, 1948, just within Uganda at Busnia on the Kenya-Uganda border. The ant was among humus and leaves, at the base of a tree with a few bushes forming an island in a banana plantation.

This species differs markedly from the only African species recorded, *filiformis* Mayr of south and west Africa. It is much smaller, has the clypeus less extended over the mandibles, the epinotum more angulate, and the petiolar node thinner.

Centromyrmex congolensis, new species

WORKER: Extended length 6.3 mm.; of thorax 1.8 mm. Head in front view squarish, exluding mandibles one and one-sixth times broader than long, occipital margin truncate, feebly concave, corners rounded anteriorly, anterior clypeal margin produced in a broad, truncate lobe; frontal lobes short, feebly convex; eyeless; mandibles falcate, outer margin broadly convex, cutting margin about twice as long as inner basal margin and with about 10 feeble and irregularly spaced denticles, apex in the form of an acute tooth; antennal scapes long and slender, slightly exceeding the occipital corners, gradually enlarged and bowed distally, first funicular segment longer than the following two segments taken together, following segments gradually thickening and lengthening to an indistinctly four- or five-segmented club, terminal segment equal in length to the three preceding ones taken together. Thorax from above with evenly convex pronotal margin, the pronotum being transversely crescent shaped, promesonotal suture marked and impressed, meso-epinotal region broadly and smoothly impressed, the lateral impressions rising obliquely forward to meet at an angle, thus isolating the epinotum as a rounded node; thorax in side view with pronotum rising sharply to form a slightly obtuse angle, mesonotum rising sharply above the pronotum and smoothly sloping into the meso-epinotal impression, the latter broad and saddle shaped, epinotum in the form of a large, convex tubercle. Petiole from above with narrow, distinct peduncle and large node which is broader than long, broader behind than in front and with truncate posterior margin; in side view with node evenly convex above and ventral surface with a short, acute spine forwardly directed. Gaster elongate-ovate with sharply truncate anterior margin and convex anterior angles; five segments exposed dorsally, of which the fifth is more constricted from the preceding than any others; sting long and exserted. Legs short and stout, the coxae strongly incrassate, the femora less so, middle tibia covered with sharp spines, the others with far fewer and more slender spines, tarsi spinose.

Shining; head finely striate-punctate, the frons largely smooth except for piligerous punctations, thorax with similar piligerous punctations, and irregularly striate, gaster and appendages smooth except for the same piligerous punctations.

Pilosity of yellow, upright hairs of variable lengths, clypeus with two long, fine hairs projecting over the mandibles, inner surface of mandibles below the denticles with shorter hairs, entire surface generally with scattered hairs; pubescence confined to the legs distally and the funiculi.

Brownish yellow, appendages slightly darker.

HOLOTYPE: One worker taken March 1, 1948, at Niangara, Belgian Congo. It was just beneath the soil surface under a thin cover of dead leaves of mango and oil palm. The ant seemed completely helpless when exposed to the daylight and writhed about when placed on the ground or in my palm. It made no attempt to run away, curling and uncurling without stinging, though it had a long, stout sting. Obviously its habitat was exclusively hypogeic, as the lack of eyes also indicates.

This remarkable ant has its middle tibia much more spinose than the fore and hind tibia, while the fore tibia is much more massive and differently proportioned compared with the others. It is possible that these structures, together with the generally stout legs, including large, globose coxae, protect the legs from being severed at any point by the strong mandibles of soldier termites. They are adapted for locomotion through the tenuous galleries of termites, where the ants may encounter their prey. The pair of hairs on the anterior clypeal margin and the short, stout hairs below the denticles on the mandibles must serve a sensory purpose to inform the ant when it has moving prey to seize. The scattered hairs over the entire surface are also doubtless sensory in lieu of eyes.

From *C. constanciae* Arnold of Rhodesia the present species differs distinctly in larger size, in less angular thorax and epinotum, and in other ways. It appears to differ from *C. sellaris* Mayr of the Cameroons in larger size (*sellaris* is given as 5.3 mm., and Santschi remarks that his specimens are still smaller) and in other ways though comparison is difficult because Mayr's description consists primarily of a comparison with an Indo-Malayan species, *feae* Emery.

This Indo-Malayan species has been repeatedly taken from the nests of termites, including the fungus-grower *Microtermes pallidus* Haviland, *Termes* species, *Odontotermes javanicus* Holmgren, *Capritermes* species, *Nasutitermes* species; and as the variety *ceylonicus* Forel in nests of *Heterotermes ceylonicus* Holmgren.

Asphinctopone lucidus, new species

WORKER: Extended length 3.5 mm.; of thorax (including neck) 1.1 mm. Head in front view, excluding mandibles, one and one-fifth times longer than broad, occipital margin feebly convex, corners broadly rounded, sides feebly convex; clypeus with a median carina which projects slightly over the anterior margin, the latter otherwise slightly concave medially and produced laterally on each side as an obtuse angle which projects over the cutting margin of the mandibles; frontal lobes fused, flat, short, and convex; eyes about 0.04 mm. in diameter, situated at the sides about four of their diameters from the base of the mandibles; mandibles narrow, triangular, evenly convex on their lateral margins, with five or six teeth exposed beyond the clypeal lobe; antennal scapes distinctly exceeding occipital angles, slender, slightly enlarged distally, slightly longer than the funiculus to the terminal segment, funiculus with three-segmented club equal in length to the preceding seven taken together. Thorax from above with well-developed neck, behind which the pronotum rises as an even convexity and is broader than the remainder of the thorax; mesonotum small and transversely elliptical, well marked from the pronotum and epinotum; meso-epinotal impression deep, epinotum with sides flattish and converging up to the basal surface, declivous surface plane and marginate at the side; thorax in side view forming one general arc interrupted by promesonotal and a much deeper meso-epinotal impression, the epinotal declivous surface being flattened. Petiolar node high and scale-like, in side view with sides converging to a narrow, convex apex; viewed from in front the scale has convex sides broadest above the middle and a slightly angulate convex apex. Gaster from above elongate-ovate, evenly convex anteriorly, first and second segments approximately equal in length and forming about two-thirds of the gaster; sting of moderate dimensions and exserted. Legs long and slender, of moderate proportions.

Shining; head densely and finely, thorax and especially epinotum more sparsely but coarsely, gaster and appendages except mandibles finely, punctate; mandibles with a few piligerous punctures. Hairs largely absent except for a dense yellow tuft at the apex of the gaster; pubescence moderately fine and dense, especially on the antennae and legs, but sparsely on the gaster.

Uniformly bright ferruginous.

HOLOTYPE: One worker taken March 12, 1948, 5 miles west of Bangassou, Ubangi-Shari, French Equatorial Africa. The ant was in well-developed gallery forest extending up a watercourse from the Mbomu River and was beneath damp leaves on the forest floor.

The genotype, *A. silvestrii* Santschi, described from Nigeria in 1914, differs distinctly in having antennal scapes failing to reach the occiput, the epinotum more steeply declivous, the petiolar scale thicker, and in other ways.

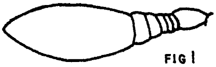

FIG I

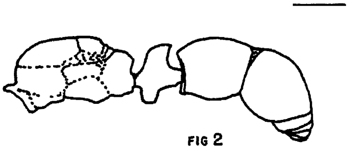

FIG 2

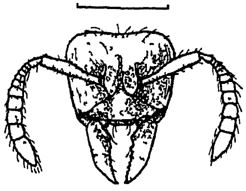

FIG 3

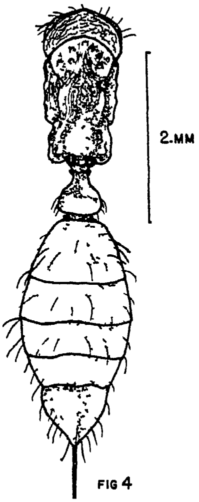

FIG 4

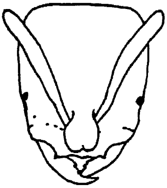

FIG 5

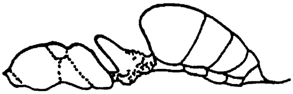

FIG 6

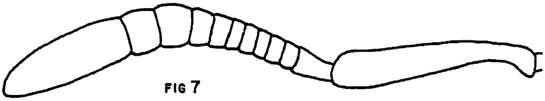

FIG 7

FIG. 1. Outline of antennal funiculus of female of *Discothyrea patrizzii*, new species.

FIG. 2. Lateral outline of thorax and abdomen of female of *Probolomyrmex parvus*, new species.

FIG. 3. Frontal view of head of worker of *Centromyrmex congolensis*, new species.

FIG. 4. Dorsal view of thorax and abdomen of worker of *Centromyrmex congolensis*, new species.

FIG. 5. Frontal outline of head of worker of *Asphinctopone lucidus*, new species.

FIG. 6. Lateral outline of thorax and abdomen of worker of *Asphinctopone lucidus*, new species.

FIG. 7. Outline of antenna of worker of *Asphinctopone lucidus*, new species.

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THE DISTRIBUTION OF *OENEIS TAYGETE* GEYER IN NORTH AMERICA WITH DESCRIPTIONS OF NEW SUBSPECIES (LEPIDOPTERA, SATYRIDÆ)

BY CYRIL FRANKLIN DOS PASSOS

INTRODUCTION

This is the first of a contemplated series of papers devoted to the Nearctic species of *Oeneis* Hübner ([1819], p. 58). It is to be followed by others dealing with single species or groups of related species. In these papers an effort will be made to untangle the involved synonymies of this difficult genus, clearly define the specific entities, especially by figures whenever possible, and show their distribution on this continent. It is hoped that the effort will result in clarifying the status of certain names and eventually lead to a revision of the genus.

The genitalia of *Oeneis* possess some excellent characters for its division into groups, chiefly in the length and breadth of the uncus and the form of the clasps. In *Oeneis taygete* Geyer ([1830], pl. [17]), the species discussed in this paper, the uncus is rather broad, and the clasps have one distinct tooth arising near the middle of the costa. About six other species of Nearctic *Oeneis* comprise the so-called *taygete* group.

The insect itself is comparatively stable in pattern. Wherever it is met it is instantly recognizable so that the subspecific characters are not very prominent or clearly defined unless good series are under examination. It has been thought well, however, to propose three new subspecific names as these differ sufficiently from one another and indicate the limits of the species habitat at its southeastern, south central, and western ranges. It is doubtful whether any more names are warranted.

All reference to *Oeneis bore hanburyi* Watkins (1928, p. 617) has been omitted purposely from this paper. The present author does not believe that *hanburyi* should be referred to *taygete.* It does not have White[1] veins on the under side of the secondaries, which is one of the prominent characters of *taygete.* It is true that this disposition of *hanburyi* leaves a gap in the distribution of *taygete* extending from the western coast of James Bay to the region of the Mackenzie Delta. But this territory, consisting of barren grounds, is quite different from the other regions in which *taygete* flies and may not be ecologically suitable for this species. Also, there may be areas within this region, thus far little explored and collected, where *taygete* does occur but has not yet been reported. However, when the choice of including or excluding *hanburyi* must be made, it seems better for the present to decide against such inclusion.

The author desires to express his sincere appreciation and grateful thanks to Dr. W. R. Sweadner, Curator of Entomology, Carnegie Museum, for the generous loan of all specimens of *taygete* in the collection of that institution. These included long series from remote localities in the far north and were of great assistance in tracing the distribution of this insect.

All photographs herein reproduced were taken by the author. The figures are about four-fifths natural size.

Oeneis taygete taygete Geyer

Figures 1–2

Oeneis Taygete GEYER, *in* Hübner, [1830], Sammlung exotischer Schmetterlinge, [vol. 3, pl. 17], figs. 1–4.

Chionobas Bootes BOISDUVAL, (*partim*), 1832, Icones historique des lépidoptères, vol. 1, p. 191, pl. 37, figs. 4–6.

Satyrus Bootes, DUPONCHEL, 1832, Histoire naturelle des lépidoptères, supplement, vol. 1, p. 211, pl. 32, figs. 3–5.

Chionobas Bootes BOISDUVAL, 1836, Species général, vol. 1, pl. 13, fig. 3.

Chionobas Bootes, BOISDUVAL AND LECONTE, (*partim*), [1837], Histoire générale . . . des lépidoptères, p. 218.

Papilio Nymphalis F[estivus] Bootes, GEYER, *in* Hübner, [September, 1837–1838], Sammlung Europäischer Schmetterlinge, vol. 1, pl. 207, figs. 1025–1028.

Chionobas Bootes, HERRICH-SCHÄFFER, [1844], . . . Schmetterlinge von Europa, vol. 1, p. 69, pl. 80, figs. 391–392.

Oeneis Taygete, HERRICH-SCHÄFFER, [1844], *op. cit.*, vol. 1, p. 70, [1843], ?pl. 24, figs. 112–115.

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[1] All color terms are those employed in "Color standards and color nomenclature" by Robert Ridgway, Washington, D. C., 1912, published by the author.

Hipp[*archia*] *Bore*, MÖSCHLER (*nec* Schneider), 1848, Stettiner Ent. Zeitschr., vol. 9, p. 173.

Chionobas Taygete, WESTWOOD, [1851], The genera of diurnal Lepidoptera, vol. 2, p. 383.

?*Chionobas Bootes*, WALLENGREN, 1853, Skandinaviens Dagfjärilar, p. 46.

Chionobas Taygete, MÖSCHLER, 1860, Wiener Ent. Monatschr., vol. 4, p. 342.

Chionobas Bootes, MÖSCHLER, 1860, *ibid.*, vol. 4, p. 342.

Chinobas [*sic*] *Taygete*, MÖSCHLER, 1863, *ibid.*, vol. 7, p. 213.

Chionobas Bore, SCUDDER (*nec* Schneider), 1865, Proc. Ent. Soc. Philadelphia, vol. 5, p. 10.

Chionobas Bootes, SCUDDER, 1865, *ibid.*, vol. 5, pp. 10, 13.

Chionobas Taygete, SCUDDER, 1865, *ibid.*, vol. 5, pp. 10, 13.

Chionobas Taygete, MÖSCHLER, 1870, Stettiner Ent. Zeitschr., vol. 31, p. 123.

Chionobas Bootes, MÖSCHLER, 1870, *ibid.*, vol. 31, p. 124.

Oeneis Polixenes Bootes, KIRBY, 1871, A synonymic catalogue of diurnal Lepidoptera, p. 70.

Oeneis Polixenes Taygete, KIRBY, 1871, *op. cit.*, p. 70.

Chionobas ?*Taygete* (*Bootes*), COUPER, 1872, Canadian Ent., vol. 4, p. 204.

Oeneis Taygete, SCUDDER, (*partim*), 1875, Bull. Buffalo Soc. Nat. Sci., vol. 2, p. 240.

Chionobas Taygete, STRECKER, 1878, Butterflies and moths of North America, p. 153.

Oeneis Bore variety *Taygete*, LANG, (*partim*), 1884, Butterflies of Europe, p. 270.

Oeneis Taygete, ELWES AND EDWARDS, 1893, Trans. Ent. Soc. London, pp. 463, 473.

Oen[*eis*] *taygete*, HEYNE, *in* Rühl, [1893], Die palaearktischen Grossschmetterlinge, vol. 1, p. 523.

Oeneis taygete, HOLLAND, 1898, The butterfly book, p. 223, pl. 27, fig. 6.

Oeneis Bore v. *Taygete*, STAUDINGER AND REBEL, (*partim*), 1901, Catalog der Lepidopteren des Palaearctischen Faunengebietes, p. 52.

?*Chionobas Taygete*, BELL, 1901, Ann. Rept. Geol. Surv. Canada, for 1898, new ser., vol. 11, p. 38 m.

Chionobas taygete, DYAR, 1902, Proc. Ent. Soc. Washington, vol. 5, p. 42.

Oeneis bore taygete, SEITZ, 1908, Macrolepidoptera of the world, vol. 1, p. 119.

Oeneis taygete (= *bootes* Bdv.), WEYMER, *in* Seitz, 1911, Macrolepidoptera of the world, vol. 5, p. 231, pl. 50g.

Oeneis taygete, GIBSON, (*partim*), 1920, Report of the Canadian Arctic expedition 1913–18, vol. 3, pt. 1, p. 12i, pl. 1, fig. 1.

Oeneis taygete, McDUNNOUGH, 1921, Canadian Ent., vol. 53, p. 82.

Oeneis taygete, HOLLAND, 1931, The butterfly book, revised ed., p. 197, pl. 27, fig. 6.

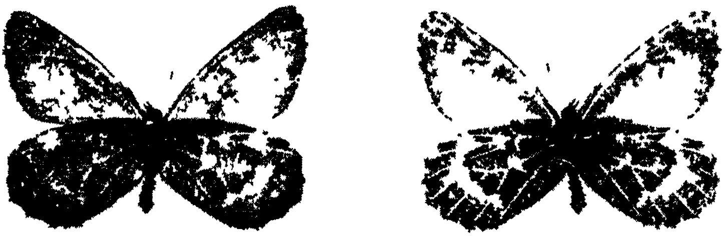
Oeneis taygete, DOS PASSOS, 1939, Bull. Cheyenne Mt. Mus., vol. 1, pt. 2, p S-10.

Since the original description of *taygete* consists of figures only, it may be convenient for those who do not have access to Hübner's work to have before them the following verbal description.

MALE

Expanse 40 to 43.4 mm., neotype 41 mm.

ABOVE: Primaries Raw Umber or Sayal Brown. Costal, outer, and part of inner margins with a narrow, Chestnut-Brown or Cinnamon-Brown line. Costa flecked with Cinnamon-Brown and White along basal area. Patch of darker androconia both sides of median vein extending to end of cell and basally to center of inner margin, lower patch being triangular. Outlined median band and broken submarginal band of under side very faintly showing through. Very seldom with a small, White pupilled subapical ocellus ringed with Black (neotype). Veins Antique Brown in basal area, blending into color of wings in discal and limbal areas. Fringes Avellaneous or Tilleul Buff checkered with Chestnut-Brown at veins. Secondaries Sayal Brown or Ochraceous-Buff, with dark median band and broken submarginal band of under side showing through. Basal and discal areas somewhat hairy. Marginal line, veins, and fringes as on primaries.



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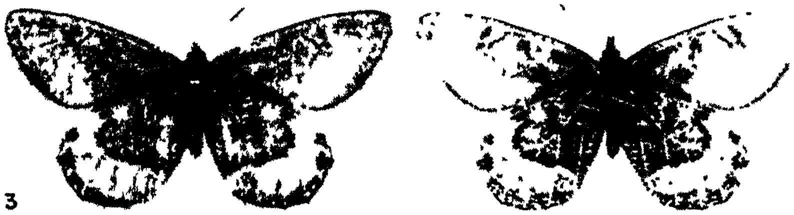


3

FIGS. 1–2. *Oeneis taygete taygete* Geyer, neotype male, upper and under sides.
FIGS. 3–4. *Oeneis bootes* (Boisduval), type male, upper and under sides.

BELOW: Primaries same color as above but paler. Costa and apex flecked with Light Seal Brown and White, usually with a faint, White subapical point. Faintly outlined median band slightly produced beyond cell, somewhat darker than wings, more heavily marked along edges and towards costa. Indistinct, broken, Hay's Brown submarginal band becoming obsolete towards inner margin. Veins Aniline Yellow in basal area, flecked with White in apical and limbal areas, blending into color of wings in limbal area. Marginal line and fringes as on upper side. Secondaries with irregular median band of Light Seal Brown, arising in center of costa and terminating at anal angle, flecked with Mars Brown and White between darker borders of band; dentate and crenulate on outer side, more regular on inner side, separated from basal area and broken submarginal band, both same color as center of median band and flecked with White, by basally narrower and distally broader lighter or Pale Olive-Buff areas, narrow submarginal band shading to light area adjoining median band. Costa same color as median band flecked with White. Veins Aniline Yellow flecked with White at base, White beyond. Marginal line of Light Seal Brown. Fringes as on upper side.

Head covered with hairs darker than basal color of wings on upper side; eyes Black; antennae ringed with Black and White, under side of club and distal half of antennae Capucine Yellow; palpi White above and at sides with Black hairs below; thorax and abdomen Black sparsely covered with hairs concolorous with wings on upper side; legs concolorous with basal area of wings on under side.

Female

Expanse 41.5 to 46.5 mm.

Above: Primaries Clay Color or Cinnamon-Buff. Basal and discal areas darker than limbal area. Costal, outer, and part of inner margins with a narrow, Prout's Brown line. Basal area of costa slightly flecked with Clay Color and White. Outlined median band and broken submarginal band of under side very faintly showing through. Very occasionally with a faint, White subapical point and three or more indistinct, Cream-Buff submarginal spots between veins. Veins and fringes as in male. Secondaries Cinnamon or Chamois, with dark basal area, median band, and broken submarginal band of under side showing through. Very occasionally with four or five Cream-Buff submarginal dots between veins. Basal and discal areas somewhat hairy. Marginal line, veins, and fringes as on primaries.

BELOW: Primaries same color as above but somewhat paler. Costa and apex flecked with Vandyke Brown and White, occasionally with a faint, White subapical point. Faintly outlined median band usually slightly produced beyond cell, somewhat darker than wings, more heavily marked along edges and towards costa. Indistinct, broken, Hay's Brown submarginal band becoming obsolete towards inner margin. Very occasionally with one White subapical point and three to four Chamois submarginal dots. Marginal line, veins, and fringes as on upper side. Secondaries with irregular median band of Seal Brown, arising in center of costa and terminating at anal angle, flecked with Verona Brown and White between darker borders of band; dentate and crenulate on outer side, rather regular on inner side, separated from basal area and broken submarginal band, both same color as center of median band and flecked with White, by basally narrower and distally broader lighter or Pale Olive-Buff areas, narrow submarginal band shading to light area adjoining median band. Costa same color as median band flecked with White. Very occasionally with four to five indistinct, Chamois submarginal spots between veins. Marginal line of Vandyke Brown. Veins and fringes as on upper side.

Head, eyes, antennae, palpi, thorax, abdomen, and legs as in male.

At the foot of the plate upon which it is figured the type locality of *Oeneis taygete* Geyer is given as "Labrador." It hereby is fixed as Hopedale, Labrador, latitude 53° N.

A neotype of *Oeneis taygete* Geyer hereby is designated as a male in the Carnegie Museum labeled "450," and "450 Oeneis Taygete Hb. ♂ Labrador Ex. Coll. O. Staudinger." Apparently the type does not exist. This is one of the few specimens seen that closely resembles the type in the color of the upper side and having one prominent subapical ocellus on the primaries. Most specimens are paler in color and lack this ocellus, although it often appears inconspicuously on the under side.

Chionobas Bootes Boisduval (*op. cit.*, p. 191), generally considered a synonym of *taygete*, was described from a number of specimens from Cap-Nord, Kamtschatka, Greenland, and Labrador. A male and female are figured by Boisduval (*op. cit.*, pl. 37, figs. 4–6). A supposed type is in the United States National Museum (figs. 3–4), *ex* collection W. Barnes, *ex* collection C. Oberthür, *ex* collection J. A. D. Boisduval. This particular specimen has never been figured before, and differs in several respects from Boisduval's figures (*loc. cit.*). It is somewhat unusual in that it shows pale submarginal markings between the veins on the upper side of the primaries and secondaries. Usually these markings occur only in the Alaskan and Coloradan subspecies, hereinafter named. Unfortunately it bears no locality data. Nothing resembling it has been seen from Cap-Nord or Labrador. No material from Kamtschatka is available for study, and the insect has never been recorded from Greenland. While this specimen may be one of the type series, it hardly can have come from Labrador. It is believed best to restrict the type, apparently no longer in existence, to the male figured by Boisduval. That male does not bear a bad resemblance to specimens of *taygete* from Labrador. It is probably on the strength of this figure that prior authors have sunk *bootes* for *taygete*. On the other hand the supposed type in the United States National Museum resembles a subspecies of *taygete*, hereinafter named from Alaska. (Compare figs. 3–4 with figs. 9–10.) It is possible therefore, that it is a Kamtschatka specimen. But in view of all the uncertainty it seems advisable to follow previous authors and even go a little further in order to settle this question for all time. Consequently, the type locality of *Chionobas Bootes* Boisduval hereby is fixed as Hopedale, Labrador.

MATERIAL EXAMINED: Three males and four females, Wolstenholme, Province of Quebec, latitude 62° 25′ N., longitude 66° 14′ W., altitude sea level, July 10–19, 1941 (R. May); two males and one female, Labrador, no dates, *ex* collection Henry Edwards; one male, Labrador, no date, *ex* collection J. Doll, all in the American Museum of Natural History; two males and one female, Labrador, no dates; seven males and seven females, same locality, no dates (A. Stecker); one male, same locality, no date, *ex* collection O. Staudinger; one female, Rama, Labrador, 1886 (Dr. Christ); four males and four females, Ramah, Labrador, no dates (A. Stecker); one male, Port Burwell, northeast entrance to Ungava Bay, Quebec, September 13, 1926 (W. E. C. Todd); one male and one female, Fort Chimo, Ungava, no dates; six males, Port Harrison, Quebec, July 4–7, 1940 (R. May); 54 males and 48 females, Belcher Island, Hudson Bay, no dates; five males, Nastapoka River, west coast of Labrador Peninsula, July 7 and 20, 1915 (O. J. Murie); one male and five females, Whale River, Hudson Bay, August 13, 1914 (W. E. C. Todd); five males and four females, Little Cape Jones River, east coast Hudson Bay, July 18, 1926 (W. E. C. Todd); nine males and three females, same locality and date (G. M. Sutton); one female, Rupert House, no date, *ex* collection T. L. Mead, all in the Carnegie Museum; one male (genitalic slide no. 251, C. F. dos Passos), [Nain], Labrador, 56° N.-Br., July 23, 1910; one male, Hopedale, Labrador, 55° N., July 19, 1928 (W. W. Perrett); four males (two genitalic slides nos. 5 and 184, and one venation slide no. 56, C. F. dos Passos), same locality, July 16–August 11, 1933; one male, same locality, July 7, 1936; one female, same locality, July 22, 1933; two females (one venation slide no. 57, C. F. dos Passos), same locality, July 8 and 22, 1936; one male, Labrador, May, 1890, 710, *ex* collection O. Staudinger, *ex* collection T. E. Bean; one female, same locality, 1888, 429, *ex* same collections; one female, no data, 21, *ex* collection T. E. Bean; three males (one genitalic slide no. 168, C. F. dos Passos) and five females, Wolstenholme, Ungava, latitude 62° 25′, longitude 66° 14′, July 1–22, 1941 (R. May); one female, Cape Wolstenholme, Hudson Strait, August 1, 1937 (F. Johansen), all in the collection of the author.

DISTRIBUTION: Quebec, north of the St. Lawrence, Labrador, Ungava, south to James Bay, the islands on the east side of Hudson Bay, and on Baffin Island. It has not been seen from the island of Newfoundland.

Oeneis taygete gaspeensis, new subspecies

Figures 5–8

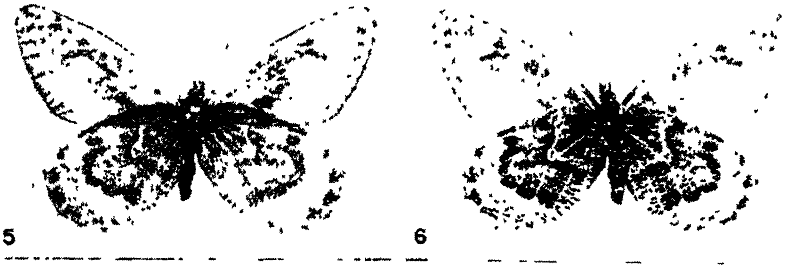
Oeneis taygete, McDUNNOUGH, 1934, Canadian Ent., vol. 66, p. 86.

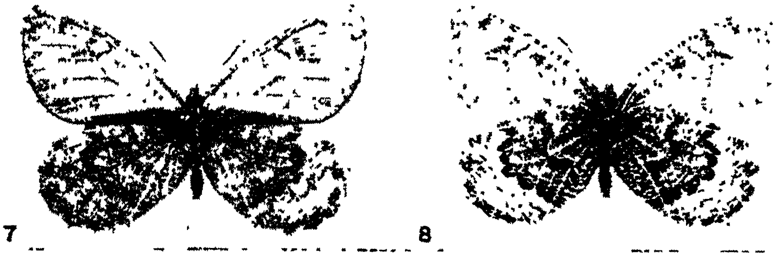
MALE

Expanse 42 to 48.5 mm., holotype 48.5 mm.

ABOVE: Primaries Snuff Brown, Tawny-Olive (holotype), or Cinnamon. Costal, outer, and part of inner margins with a narrow, Bister line. Costa flecked with White along basal area. Patch of darker androconia both sides of median vein extending to end of cell. Outlined median band and broken submarginal band of under side faintly showing through. Veins Ochraceous-Buff in basal and discal areas, blending into color of wings in limbal area. Fringes Pale Olive-Buff checkered with Bister at veins. Secondaries Sayal Brown, Tawny-Olive, or Cinnamon (holotype), with darker basal area, broad median band, and broken submarginal band of under side showing through. Occasionally with three to four indistinct, light submarginal spots between veins. Basal and discal areas somewhat hairy. Less distinct marginal line; veins and fringes as on primaries.

BELOW: Primaries same color as above but paler. Costa flecked with White and Light Seal Brown or Hay's Brown. Apex flecked with Light Seal Brown and White, occasionally with a White subapical point. Broad median band sharply produced beyond cell, slightly darker than wings, more heavily marked along edges and towards costa. Broken, Light Seal Brown submarginal band becoming indistinct towards inner margin. Veins Ochraceous-Buff in basal area, flecked with White in apical area, blending into color of wings in limbal area. Marginal line and fringes as on upper side. Secondaries with broad, irregular median band of Light Seal Brown or Hay's Brown, arising in center of costa and terminating at anal angle, flecked more or less with Snuff Brown and little White between darker borders of band; dentate





FIGS. 5–6. *Oeneis taygete gaspeensis* dos Passos, holotype male, upper and under sides.

FIGS. 7–8. *Oeneis taygete gaspeensis* dos Passos, allotype female, upper and under sides.

and crenulate on outer side, more regular on inner side, separated from darker basal area and broken submarginal band, both usually same color as median band and flecked with White, by basally narrower and distally broader lighter or Pale Olive-Buff areas, submarginal band shading to lighter margin and gradually to light area adjoining median band. Costa same color as median band flecked with White. Veins Aniline Yellow flecked with White at base, White beyond. Faint marginal line on outer and inner margins and fringes as on upper side.

Head covered with hairs darker than basal color of wings on upper side; eyes Warm Blackish Brown; antennae ringed with Black and White, under side of club and distal third of antennae Ochraceous-Orange; palpi White above and at sides with Black hairs below; thorax and abdomen Black sparsely covered with hairs concolorous with wings on upper side; legs concolorous with basal area of wings on under side.

FEMALE

Expanse 43.4 to 49.5 mm., allotype 46 mm.

ABOVE: Primaries Sayal Brown, Tawny-Olive (allotype), or Chamois. Basal and discal areas darker than limbal area. Costal, outer, and part of inner margins with a narrow, Bister line. Costa, except limbal area, flecked with White. Outlined median band and broken submarginal band of under side faintly showing through. Veins and fringes as in male. Secondaries same color as primaries but slightly paler, with darker basal area, broad median band, and broken submarginal band of under side distinctly showing through. Occasionally with three to four indistinct, light submarginal spots between veins. Basal and discal areas somewhat hairy. Less distinct marginal line; veins and fringes as on primaries.

BELOW: Primaries same color as above but paler. Costa flecked with White and Seal Brown or Warm Sepia. Apex flecked with Vandyke Brown and White, occasionally with a White subapical point. Broad median band usually sharply produced beyond cell, darker than wings, more heavily marked along edges and towards costa. Broken, Seal Brown submarginal band becoming indistinct towards inner margin. Veins Ochraceous-Buff in basal area, heavily flecked with White in apical area, blending into color of wings in limbal area slightly flecked with White. Marginal line and fringes as on upper side.

Secondaries with broad, irregular median band of Seal Brown or Warm Sepia, arising in center of costa and terminating at anal angle, flecked more or less with Cinnamon-Buff or Clay Color and White between darker borders of band; dentate and crenulate on outer side, more regular on inner side, separated from darker basal area and broken submarginal band, both usually same color as median band and flecked with White, by basally narrower and distally broader lighter or Pale Olive-Buff areas, submarginal band shading to lighter margin and gradually to light area adjoining median band. Costa same color as median band flecked with White. Veins Aniline Yellow flecked with White at base, White beyond. Faint marginal line on outer and inner margins and fringes as on upper side.

Head, eyes, antennae, palpi, thorax, abdomen, and legs as in male.

The author is indebted to Dr. A. E. Brower, Mr. A. C. Frederick, and Dr. A. B. Klots for kindly submitting to him for study the long series of this subspecies collected by them and their generous gifts of many of these specimens.

This subspecies differs from *taygete taygete* in its consistently larger size, its somewhat mottled, darker color on the upper side, and its wider median band on the under side of the secondaries. The under side of the hind wings is less contrasting, owing to the fact that usually the area on both sides of the median band has fewer White scales and the veins are not so prominently flecked with White.

With *gaspeensis* on Mt. Albert, but at lower elevations, two other *Oeneis* occur. One of these, *polixenes* (Fabricius) (1775, p. 484) flies at about 3000 feet and occurs at a slightly earlier date. The other, *chryxus calais* (Scudder) (1865, p. 7) occurs still lower at about 2000 feet, and also earlier in the season. This is the most southern locality known for *polixenes* in the east, but some subspecies of *chryxus* (Doubleday and Hewitson) ([1851], p. 383) occur in more southerly localities in the middle west and the Rocky Mountains.

TYPE MATERIAL: The holotype male is from Mt. Albert, Quebec, July 19, 1940 (A. E. Brower) and the allotype female is from Mt. Albert, Gaspé National Park, Quebec, Arctic Alpine Zone, meadow, altitude 3600 feet, July 18–21, 1940 (A. B. Klots). There are 35 male and 30 female paratypes from Quebec as follows: 18 males (one genitalic slide no. 185, C. F. dos

Passos) and 17 females, Mt. Albert, July 19–22, 1940 (A. E. Brower); 12 males (one genitalic slide no. 170, C. F. dos Passos) and nine females, Mt. Albert, Gaspé County, 3500 feet, July 19, 1940 (A. C. Frederick); five males and four females, Mt. Albert, Gaspé National Park, Arctic Alpine Zone, meadow, altitudes 3600–3750 feet, July 18–21, 1940 (A. B. Klots). The holotype, *ex* collection A. E. Brower, and allotype, *ex* collection A. B. Klots, are in the American Museum of Natural History, both *ex* collection C. F. dos Passos. One pair of paratypes, *ex* collections A. E. Brower and A. C. Frederick, is in the Carnegie Museum, *ex* collection C. F. dos Passos. Of the above paratypes 14 males and 12 females are in the collection of A. E. Brower, 10 males and seven females are in the collection of A. C. Frederick, and five males and four females are in the collection of A. B. Klots, some of which have been distributed. The remaining paratypes are in the collection of the author.

ADDITIONAL MATERIAL EXAMINED: The author has examined also the following specimens of *gaspeensis* from Quebec, but they are not made paratypes: eight males and one female, Mt. Albert, Gaspé County, 3500 feet, July 18–19, 1940 (A. C. Frederick); 18 males (two genitalic slides nos. 161 and 164, C. F. dos Passos) and nine females, Mt. Albert, Gaspé National Park, Arctic Alpine Zone, meadow, altitude 3500–3750 feet, July 18–21, 1940 (A. B. Klots), all in the collection of the author.

DISTRIBUTION: Quebec, south of the St. Lawrence.

Oeneis taygete fordi, new subspecies

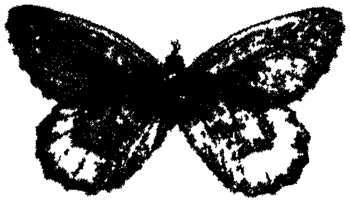
Figures 9–12

Chionobas Taygete, EDWARDS, 1886, Report upon diurnal Lepidoptera collected in Alaska by E. W. Nelson, pt. 4, Insects, p. 329.

MALE

Expanse 39 to 47 mm., holotype 43 mm.

ABOVE: Primaries Cinnamon-Brown, Ochraceous-Tawny (holotype), or Cinnamon. Costal, outer, and part of inner margins with a distinct, narrow, Chestnut-Brown or Brussels Brown line. Costa slightly flecked with White along basal area. Patch of darker androconia both sides of median vein extending to end of cell. Slight indication of broken submarginal band of under side showing through. Occasionally with a White subapical point. Veins Brussels Brown in basal and discal areas, blending into color of wings in limbal area Fringes Avellaneous or Cartridge Buff checkered with Chestnut-Brown or Brussels Brown at veins Secondaries Cinnamon-Brown, Antimony Yellow (holotype), or Honey Yellow, with dark median band and broken submarginal band of under side showing through Sometimes with four or five Cream-Buff or Cartridge Buff submarginal dots between veins. Basal and discal areas slightly hairy. Marginal line, veins, and fringes as on primaries.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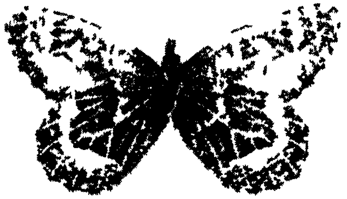
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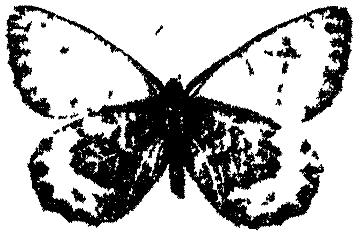
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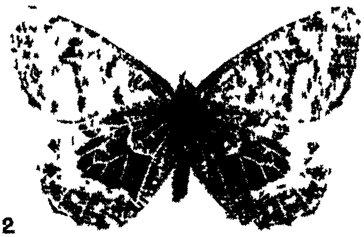
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Figs 9–10 *Oeneis taygete fordi* dos Passos, holotype male, upper and under sides.

Figs. 11–12 *Oeneis taygete fordi* dos Passos, allotype female, upper and under sides

Below: Primaries same color as above but paler. Costa and apex flecked with Seal Brown, often with a White subapical point. Broad median band bluntly produced beyond cell, slightly darker than wings, more heavily marked along edges and towards costa. Sometimes with broken, indistinct, Seal Brown submarginal band disappearing towards inner margin. Two to four small, Cartridge Buff submarginal spots between veins. Veins Ochraceous-Buff in basal area, flecked with White in apical area, blending into color of wings in limbal area. Marginal line and fringes as on upper side. Secondaries with broad, irregular median band of Carob Brown or Seal Brown, arising in center of costa and terminating at anal angle, flecked more or less with Ochraceous-Tawny or Cinnamon-Brown and White between darker borders of band; slightly dentate and crenulate on outer side, more regular on inner side, separated from basal area and broken submarginal band, both usually same color as center of median band, sometimes same color as borders of median band, and flecked with White, by basally narrower and distally broader lighter or Pale Olive-Buff areas, submarginal band shading to light area adjoining median band. Costa same color as median band flecked with White. Five or six small, White submarginal points between veins. Veins Cream-Buff, heavily flecked with White at base, White beyond. Marginal line of Light Seal Brown. Fringes as on upper side.

Head covered with hairs darker than basal color of wings on upper side; eyes Liver Brown; antennae annulated, White, shading into Black and White on upper side, under side of club and distal half of antennae Salmon-Orange; palpi White above and at sides with Prout's Brown hairs below; thorax and abdomen hairy, Prout's Brown; legs concolorous with basal area of wings on under side.

FEMALE

Expanse 39.5 to 48 mm., allotype 45 mm.

ABOVE: Primaries Tawny-Olive, Clay Color (allotype), or Honey Yellow. Basal and limbal areas lighter than discal area. Costal, outer, and part of inner margins with a narrow, Brussels Brown or Chestnut-Brown line. Costa, except limbal area, flecked with White. Median band and broken submarginal band of under side distinctly showing through, both somewhat darker than wings, the latter distinct in some specimens and resulting in short, dark lines between veins. Occasionally with a faint, White subapical point and three or more indistinct, Cream-Buff submarginal spots between veins. Veins and fringes as in male. Secondaries same color as primaries but slightly paler, with dark median band and broken submarginal band of under side showing through. Sometimes with four or five Cream-Buff submarginal dots between veins. Basal and discal areas somewhat hairy. Less distinct marginal line; veins and fringes as on primaries.

BELOW: Primaries same color as above but paler. Costa and apex flecked with Vandyke Brown and White. Broad median band bluntly produced beyond cell, darker than wings, more heavily marked along edges and towards costa. Broken, Light Seal Brown submarginal band sometimes becoming obsolete at inner margin. One White subapical point and three to four Chamois submarginal dots. Veins Antimony Yellow in basal area, flecked with White in apical area, blending into color of wings in limbal area. Marginal line and fringes as on upper side. Secondaries with broad, irregular median band of Light Seal Brown or Vandyke Brown, arising in center of costa and terminating at anal angle, flecked more or less with Sayal Brown, Tawny-Olive, or Cinnamon-Brown and White between darker borders of band; dentate and crenulate on outer side, more regular on inner side, separated from basal area and broken submarginal band, both usually same color as center of median band, sometimes same color as borders of median band, and flecked with White, by basally narrower and distally broader lighter or Pale Olive-Buff areas, submarginal band shading to light area adjoining median band. Costa same color as median band flecked with White. Usually with four to five Chamois, sometimes White, submarginal points between veins. Marginal line, veins, and fringes as on upper side.

Head, eyes, antennae, palpi, thorax, abdomen, and legs as in male.

This subspecies is named for my friend, Dr. E. B. Ford, Reader in Genetics in the University of Oxford.

Oeneis taygete fordi differs from *taygete taygete* in its color, prominent submarginal markings on the primaries and secondaries of the upper and under sides of both sexes, and in the color of the hairs on the head, thorax, and abdomen. These are the most obvious differences, but there are others as will appear from a comparison of the descriptions.

TYPE MATERIAL: The holotype male (genitalic slide no. 109, C. F. dos Passos) and the allotype female are from the Kuskokwim River, Alaska, no dates (A. Stecker), *ex* collection Carnegie Museum. There are 10 paratypes from Alaska as follows: three males and three females, Kuskokwim River, no dates (A. Stecker), *ex* collection W. J. Holland, *ex* collection Carnegie Museum; one male, same locality and collector, no date, *ex* collection Carnegie Museum; one male, Alaska, North America, 80, no date; two females same locality, 81 and 82, no dates. The holotype and allotype are in the Carnegie

Museum, and one pair of paratypes is in the American Museum of Natural History, all *ex* collection C. F. dos Passos. A pair of paratypes will be sent to the University Museum, Oxford. The remaining paratypes are in the collection of the author.

ADDITIONAL MATERIAL EXAMINED: The author has examined also the following specimens of *fordi*, but they are not made paratypes: one male and one female, Kuskokwim River, no dates (A. Stecker); one male, Teller, Alaska, July 18, 1928, all in the American Museum of Natural History; one male, Alaska, no date; one female, North Alaska, no date; one male, Mt. McKinley, Alaska, July, 1925, *ex* collection W. R. Sweadner; 74 males and 21 females, Kuskokwim River, no dates except one female, 1907 (A. Stecker), *ex* collection W. J. Holland; one male, St. Michaels, Alaska, no date; one female, St. Michael, Alaska, July 4, 1904 (S. H. Young) all in the Carnegie Museum; one male, Fort Yukon, Alaska, 66.5° N., no date; one male and two females, Alaska, no dates, *ex* collection O. Staudinger; one male, Whitehorse, Yukon Territory, Canada, June 16, all in the collection of the author.

DISTRIBUTION: Alaska, Yukon, District of Mackenzie.

Oeneis taygete edwardsi, new subspecies

Figures 13–16

?*Chionobas Taygete*, EDWARDS, 1885, Canadian Ent., vol. 17, p. 158 (footnote).

?*C[hionobas] Taygete*, EDWARDS, 1886, *ibid.*, vol. 18, p. 16.

?*Chionobas Bore*, EDWARDS (*nec* Schneider), 1891, *ibid.*, vol. 23, p. 16.

?[*Chionobas*] *Taygete*, EDWARDS, 1891, *ibid.*, vol. 23, p. 32.

?*Oeneis bore*, BUTLER (*nec* Schneider), 1893, Ann. Mag. Nat. Hist., ser. 6, vol. 12, p. 12.

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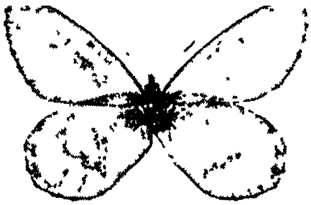
Oeneis taygete, CADBURY, 3D, 1937, Proc. Acad. Nat. Sci. Philadelphia, vol. 89, p. 397.

MALE

Expanse 36 to 41.5 mm., holotype 41 mm.

ABOVE: Primaries Snuff Brown (holotype) or Wood Brown. Costal, outer, and part of inner margins with a very distinct, narrow, Brussels Brown or Raw Umber line. Faint patch of androconia both sides of median vein extending almost to end of cell. Veins Orange-Buff in basal area, blending into color of wings in discal and limbal areas. Fringes Avellaneous or Tilleul Buff broadly checkered with Brussels Brown or Raw Umber at veins. Secondaries same color as primaries but slightly paler, with dark median band and indistinct, broken submarginal band of under side faintly showing through. Occasionally with four or five Cream-Buff or Chamois submarginal dots between veins. Basal and discal areas sparsely covered with hairs. Marginal line, veins, and fringes as on primaries.



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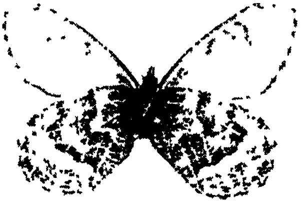

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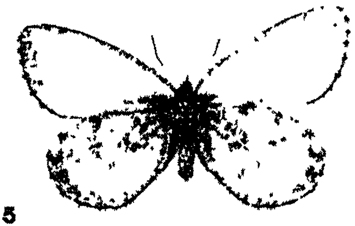

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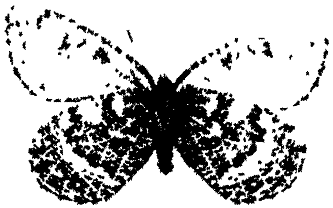

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Figs. 13–14. *Oeneis taygete edwardsi* dos Passos, holotype male, upper and under sides.

Figs. 15–16. *Oeneis taygete edwardsi* dos Passos, allotype female, upper and under sides.

Below: Primaries same color as above but slightly paler. Costa and apex flecked with Hay's Brown. Faintly outlined, broad median band bluntly produced beyond cell, slightly darker than wings, more heavily marked in and beyond cell, nearly obsolete at inner margin. Indistinct, Hay's Brown submarginal band becoming obsolete halfway to inner margin. Veins Orange-Buff in basal area, flecked with White in apical area, blending into color of wings in limbal area. Marginal line and fringes as on upper side. Secondaries with broad, irregular median band of Warm Blackish Brown or Seal Brown, arising in center of costa and terminating at anal angle, flecked more or less with Snuff Brown and White between darker borders of band; slightly dentate and crenulate on outer side, more regular on inner side, separated from basal area and broken submarginal band, both same color as center of median band and flecked with White, by basally narrower and distally broader lighter or Pale Olive-Buff areas, submarginal band shading to light area adjoining median band. Costa same color as median band flecked with White. Occasionally with five or six small, Cream-Buff submarginal points between veins. Veins Orange-Buff flecked with White at base, White beyond. Marginal line of Seal Brown. Fringes as on upper side.

Head covered with hairs darker than basal color of wings on upper side; eyes Chestnut-Brown; antennae ringed with Black and White, under side of club and distal half of antennae Capucine Yellow; palpi White above and at sides with Vandyke Brown hairs below; thorax and abdomen Black; legs concolorous with basal area of wings on under side.

FEMALE

Expanse 43 to 46 mm., allotype 44 mm.

ABOVE: Primaries Clay Color (allotype) or Honey Yellow. Basal and discal areas somewhat darker than limbal area. Costal, outer, and part of inner margins with a very distinct, narrow, Clove Brown line. Costa, except limbal area, flecked with Clove Brown and Smoke Gray. Outlined median band and indistinct, narrow submarginal band of under side faintly showing through, both somewhat darker than wings. Occasionally with a faint, White subapical point and three or more indistinct, Cream-Buff submarginal dots between veins. Veins Orange-Buff in basal and discal areas, blending into color of wings in limbal area. Fringes as in male. Secondaries same color as primaries, with dark median band and broken submarginal band of under side showing through. Usually four to five Cream-Buff submarginal spots between veins. Basal and discal areas somewhat hairy. Rather less distinct marginal line; veins and fringes as on primaries.

BELOW: Primaries same color as above but paler. Costa and apex flecked with Vandyke Brown and White. Faintly outlined median band, sometimes obsolete, bluntly produced beyond cell, darker than wings, more heavily marked in and beyond cell. Faint, Clove Brown submarginal band sometimes becoming obsolete at inner margin. An occasional White subapical point and another near inner angle. Veins Orange-Buff in basal area, flecked with White in apical area, blending into color of wings in limbal area. Marginal line and fringes as on upper side. Secondaries with broad, irregular median band of Warm Blackish Brown or Seal Brown, arising in center of costa and terminating at anal angle, flecked more or less with Snuff Brown and White between darker borders of band; dentate and crenulate on outer side, more regular on inner side, separated from basal area and broken submarginal band, both same color as center of median band and flecked with White, by basally narrower and distally broader lighter or Pale Olive-Buff areas, submarginal band shading to light area adjoining median band. Costa same color as median band flecked with White. Usually with four to five White, occasionally Chamois, submarginal spots between veins. Veins Orange-Buff in basal area, blending into White at median band. Distinct marginal line and fringes as on upper side.

Head, eyes, antennae, palpi, thorax, abdomen, and legs as in male.

This subspecies differs from the other subspecies of *taygete* in that the marginal lines on both wings are much more distinct. The entire insect has a frailer appearance, all markings including the androconia being paler. Superficially *edwardsi* is nearest to *taygete taygete*, the more southern specimens of which from Alberta and British Columbia are referred to this new name.

Many other species of *Oeneis* also occur in Colorado, Wyoming, and Montana. At the highest elevation in Colorado *polixenes* has been taken. From the lowest elevations *jutta reducta* McDunnough (1929, p. 105) has been recorded. At intermediate levels are found *alberta oslari* (Skinner) (1911, p. 220), *lucilla* Barnes and McDunnough (1918, p. 69), *uhleri* (Reakirt) (1866, p. 143), *chryxus*, and *brucei* (Edwards) (1891, p. 33). Of all the states and provinces, Colorado appears to have the largest *Oeneis* population. According to McDunnough (*tom. cit.*, p. 136) *taygete* (*edwardsi*) and *brucei* fly together in southern Alberta on dry, grassy hillsides.

TYPE MATERIAL: The holotype male (genitalic slide no. 162, C. F. dos Passos) is from San Juan Mountains, Hinsdale County, Colorado, August 4, 1941, and the allotype female is from Hinsdale County, Colorado, same date (both B. Rotger). There are 17 paratypes as follows: one male (genitalic slide no. 196, C. F.

dos Passos), Beartooth Plateau, [Montana or Wyoming], July 28, 1933; six males, Beartooth Plateau, Beartooth Mountains, Park County, Wyoming, July 29, 1942; three males and one female, Beartooth Plateau, Beartooth Mountains, Carbon County, Montana, July 28, 1942; one female, same locality, August 9, 1941; one female, same locality, August 12, 1941 (all G. H. and J. L. Sperry); two males (one genitalic slide no. 169, C. F. dos Passos), Marvel, La Plata County, Colorado, August 4, 1941; one male, same locality, August 6, 1941; one female, San Juan Mountains, Hinsdale County, Colorado, August 4, 1941 (all B. Rotger). The holotype and allotype are in the American Museum of Natural History, *ex* collection C. F. dos Passos. The paratypes are in the collection of the author.

DISTRIBUTION: Southern Alberta, southern British Columbia, Montana, Wyoming, Colorado.

SUMMARY

No one, and least of all the author, appreciates the great difficulty involved in preparing satisfactory verbal descriptions of the *Oeneis* discussed herein. For that reason it is especially important to refer to the figures where, it is believed, the different characters described and discussed in this paper stand out rather clearly. Furthermore, for the benefit of those who do not have Ridgway's work at hand, a brief résumé of the color differences is given below in non-technical color terms. It should be observed that the females vary more in color than the males.

	MALES	FEMALES
taygete taygete	Yellow brown	Usually yellow brown, occasionally very pale
taygete gaspeensis	Chocolate brown	Pale chocolate brown, occasionally very pale
taygete fordi	Orange brown	Usually orange to pale orange brown, occasionally pale chocolate brown
taygete edwardsi	Gray brown	Gray yellow brown or yellow brown

With the foregoing aids it is believed that there should be little or no difficulty in appreciating the distinctions pointed out in the text.

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THE HUMERUS FROM FISH TO MAN[1]

By William K. Gregory

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PREREQUISITE, PREADAPTIVE STAGES

The humerus, the bone of the upper arm, is not found in any animal phylum except the Chordata, and among the latter it is, of course, absent in limbless or snake-like forms.

The oldest known chordates, ranging from Ordovician to Upper Devonian times, belonged to the Class Ostracodermi, which even at that remote period were bilaterally symmetrical fishes (fig. 1) with segmentally arranged muscle flakes along the sides of the body. These myomeres were then the primitive locomotor organs, which have been transmitted with increasing modification to all later vertebrates. What is probably one of the oldest types of body form among the ostracoderms (fig. 1A) consisted of: (1) a rounded head shield, housing the brain and covering the mouth and branchial chamber, followed by (2) a muscular, thoracico-abdominal region, and (3) a muscular, tapering tail. The ventral surface was already more or less flattened, and the paired eyes

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[1] Based partly on a paper read before the Viking Fund Conference on Locomotion, New York, February 7, 1948.

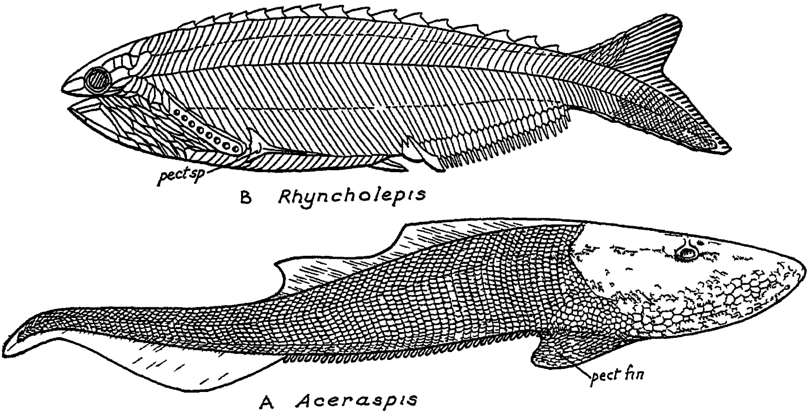
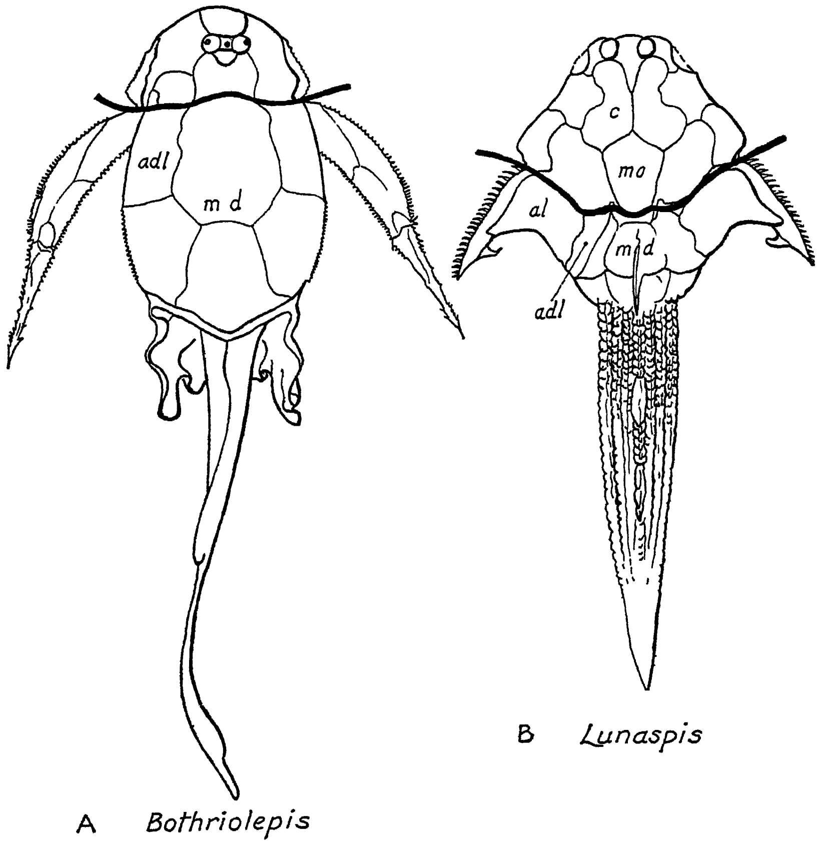


FIG 1 Ostracoderms of Upper Silurian or Lower Devonian age After Kiaer

were either on the side of the mouth or on top of the shield. In some of the Pterapsida the body form, although somewhat flattened ventrally, was almost fish-like. In others it was dorso-ventrally flattened and more or less skate-like. In the Anaspida (fig. 1B), which were probably specialized for rapid swimming, the head shield was greatly reduced, exposing the large oralo-branchial region, the body was elongate, more or less laterally compressed. In all known ostracoderms the tail tip was turned more or less downward.

Both median and paired fins or lappets in the ostracoderms (fig. 1A), as in fishes generally, served mostly as cutwaters, bilge keels, and rudders, the main locomotor thrusts coming from the lateral muscles. In most of the cephalaspids there were more or less muscular extensions of the body wall at the outer rear margins of the shield (fig. 1A). These "pectoral fins" were supported by an "endoskeletal pectoral girdle" (Stensio, 1927, 1932).

The exoskeleton in most ostracoderms, from the Ordovician *Astrapis* upward, was a highly organized complex of stratified, bony or near bony deposits, evidently a by-product of calcium metabolism. In Cephalaspida there was also extensive endoskeletal tissue as in the interbranchial septa and in the endoskeletal shoulder girdle (Stensio, *op. cit.*). This endoskeletal tissue of the earlier chordates was doubtless the material out of which the humerus, along with all other bones of the paired appendages, was later fashioned.



A *Bothriolepis*

B *Lunaspis*

FIG 2 Devonian antiarch (A) and macropetalichthyid (B) A after Patten, B after Broili and Schroder

The Upper Silurian and Devonian Antiarchi, typified by the well-known *Pterichthys* of Great Britain and *Bothriolepis* (fig. 2A) of North America, had a rounded head shield, a large domed thorax, and a tapering caudal sweep. Their long, pointed, swimming appendages were covered with an elaborate system of dermbone armor plates and had neatly turned joints at the functional shoulder and elbow. The upper-arm piece articulated by a convex head, which was received into a goblet-like outgrowth from the anteroventral corner of the bony thorax. According to Stensio (1931, pp. 111, 112) there was also an endoskeletal core with concentric layers of lime, at least in the upper arm, so that he re-

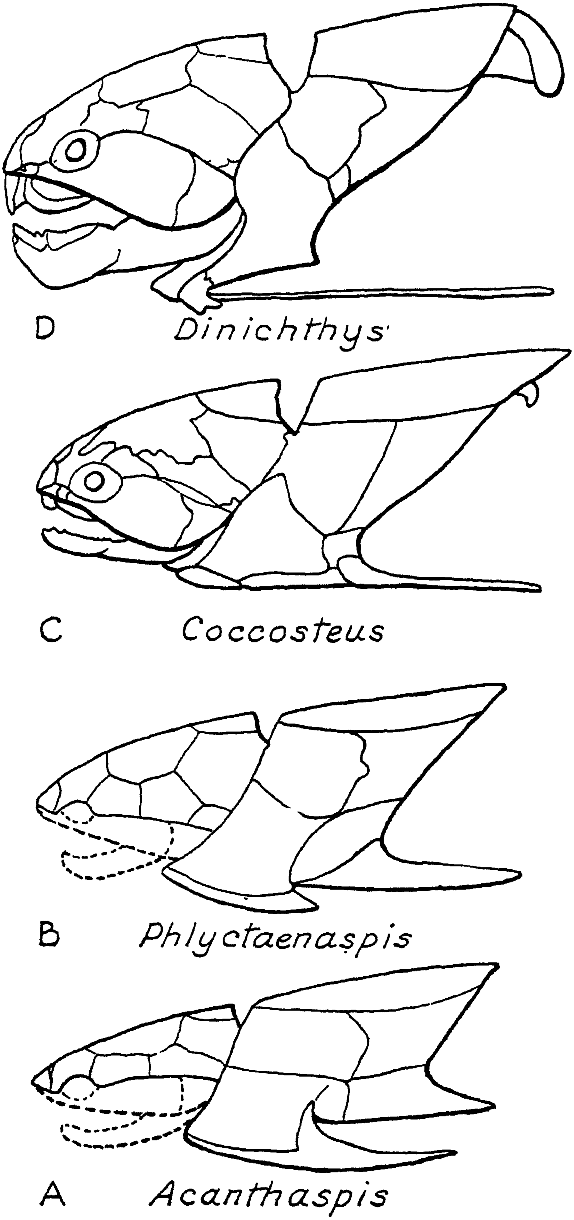


FIG. 3. Structural evolution of the head shield and thoracic buckler in acanthaspids and arthrodirans. After Heintz.

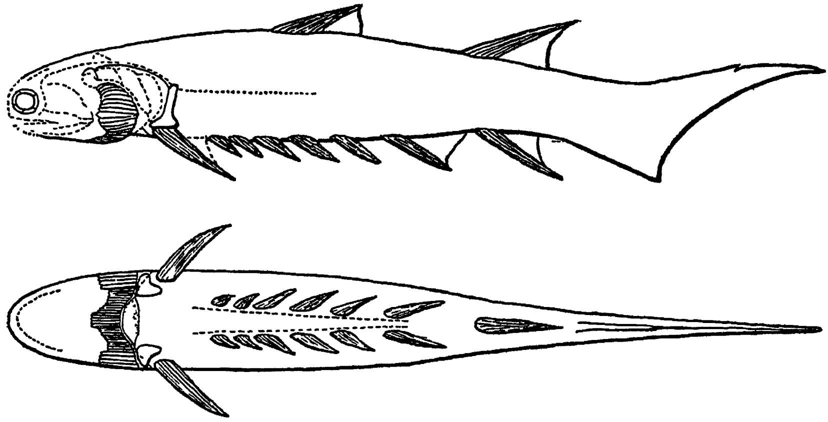


FIG. 4. Restoration of a primitive acanthodian. After Watson.

gards the entire organ as the homologue of the pectoral fin of fishes.

Among the Placodermata, also of Upper Silurian to Devonian age, we find a similarly wide range of body forms, including the shark-like Stegoselachia (fig. 2B), the skate-like Rhenanida, and the joint-necked Arthrodira (fig. 3). In general the less specialized forms (e.g., fig. 3B) had a well-developed bony head shield and thorax. In the arthrodires, as Heintz (1931) has shown, the bony thoracic shell shortened up (fig. 3C, D) until it looked like the exoskeletal shoulder girdle of bony fishes; while the pectoral appendages, already spike-like in the Acanthaspida (fig. 3A), dwindled into vestiges. In the Stegoselachia, on the contrary, both the pectoral and pelvic appendages were supported by endoskeletal pieces which collectively are remarkably like those of sharks (Broili, 1933).

The Devonian to Permian Acanthodii were formerly regarded as a peculiar side branch of the sharks, but Watson (1937) especially has shown that in some respects they are much more primitive than sharks in the structure of their skull, jaws, hyoid and gill arches. Their pectoral appendages (fig. 4) consisted chiefly of a pair of long spikes, apparently derived from minute, closely crowded and coalesced dermal denticles. At least in some acanthodians (fig. 5A) there was a web of skin near the base of the pectoral spine, and within this web were a few bony pieces which

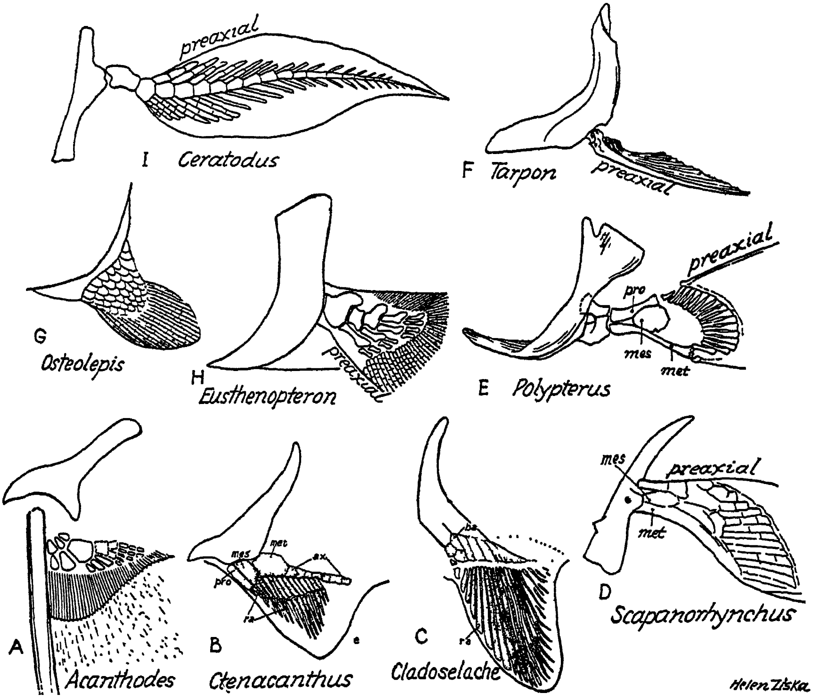


FIG. 5. Morphology of the pectoral fins. A. Acanthodian. B–D. Fossil and Recent sharks. E. Surviving ganoid. F. Modern teleost. G, H. Lobe fins (crossopterygians). I. Modern lung fish. From Gregory and Raven.

suggest the basals and radials of sharks. The pectoral girdle in acanthodians (fig. 4) may, as a whole, be homologous with the thoracic armor of placoderms (fig. 3). Ventrally it includes on each side several pieces which supported the pectoral spines, but the possible homologies of these pieces with the basal pieces of sharks and with the humerus of Crossopterygii (fig. 6B) are uncertain.

Heintz (1931; 1938, pp. 19–25) has suggested that among arthrodires the reduction and elimination of the large pectoral spines in coccosteid arthrodires might well have cleared the way for the expansion of the web and its supporting and activating rods, as in the macropetalichthyids. In the earlier acanthodians (fig. 4) as well as in certain anaspid ostracoderms the paired pectoral spikes form the first of a longitudinal series on either side.

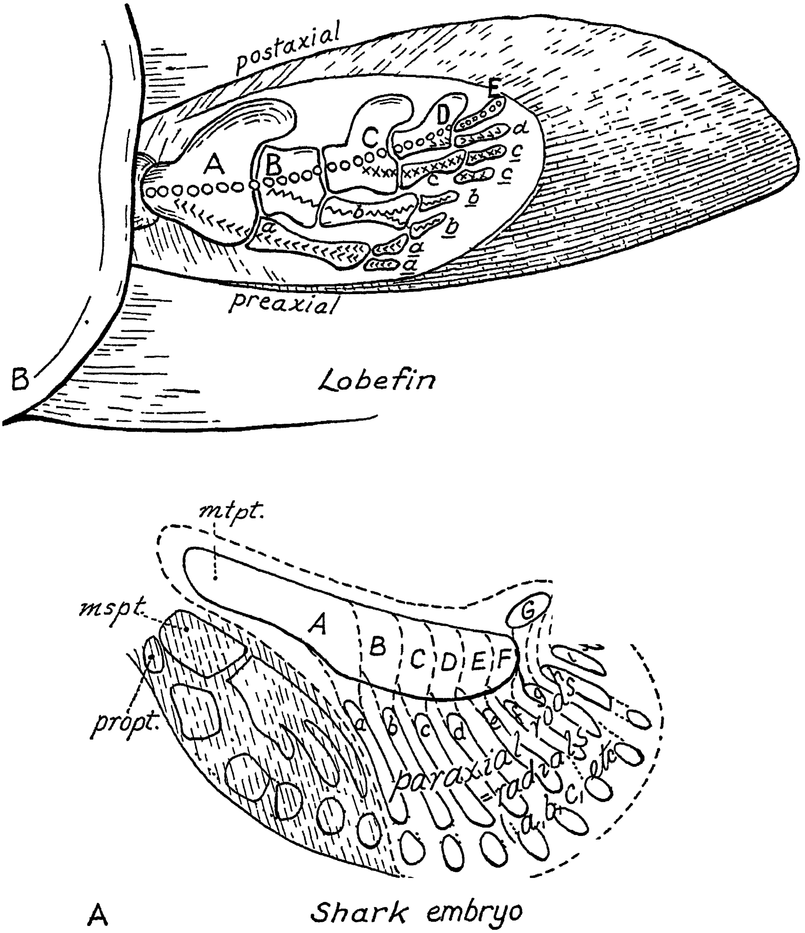


FIG. 6. Skeletal patterns of pectoral fins of lobe fin (B) and shark embryo (A). A after Moy Thomas; B after Gregory and Raven. In A the area with interrupted lines indicates the parts that are reduced or lost in B.

In the ventral view (fig. 4) these rows of spines converged towards the paired pelvic and median anal fins. Such rows of fins have been regarded as remnants of the spineless longitudinal finfolds of larval sharks and of the Upper Devonian shark *Cladoselache* (fig. 5C), but there is evidence for the very early emphasis of the exoskeleton in the great number of Paleozoic spine-bearing fishes, including macropetalichthyids, acanthaspids, acanthodians, and true sharks, and there is further evidence for the reduction of spines in *Microbrachius* among the antiarchs and in the macropetalichthyids (*Lunaspis* to *Macropetalichthys*). Thus the spinelessness of *Jaymoytius* (E. I. White, 1946) and *Cladoselache* (Dean, 1909) may not safely be assumed as primitive. Moreover the absence of large paired fin spines in *Cladoselache* (fig. 5C) is associated with a general reduction of the exoskeleton (even the shagreen denticles being extremely small) and with a great multiplication of endoskeletal rods ("radials") which extend outward almost to the edge of the wide-based pectoral (fig. 5C) and pelvic fins. Doubtless these endoskeletal rods were secreted between the myocommata covering adjacent prolongations of the myomeres.

In typical sharks the radial rods converge medially towards three basal pieces, the propterygium, mesopterygium, and metapterygium (fig. 6A). Of these there is some evidence that the metapterygium is at least functionally analogous with a humerus.

THE FIRST TRUE HUMERI

A true humerus first appears in the Devonian Dipnoi and Crossopterygii. In the Dipnoi distal multiplication of the metapterygial units eventually produced a tapering, leaf-like paddle (fig. 7F), which in *Protopterus* (fig. 7G) and *Lepidosiren* became filiform. In *Neoceratodus* (fig. 7F) the diminishing cone-in-cone arrangement of the muscles that move the pectoral fin indicates their derivation by the successive budding of myomeres. An arrest of axial growth and a lateral spreading out of the series of pre-axial radials would approach the fan-like pectoral paddle of the rhipidistian Crossopterygii, as long ago noted by Braus (1901), Goodrich (1909), and others. In *Eusthenopteron* (fig. 6B) distal multiplication of the metapterygial segments had indeed ceased with the fifth mesomere (E), while the large proximal or humeral segment (A) grew wider and developed a strong distal-medial (entocondylar) process, probably for chevron-like muscles that fanned out towards the radials (a,b,c,d). Thus emerged (fig. 8A2, C) a single shoulder joint and a two-part elbow joint. The larger elbow joint (AB) was for the short, succeeding mesomere (B), analogous in position with an ulna (U); the smaller one (Aa) for a slender, rod-like, pre-axial piece (a) that suggests a radius (R).

These features were all prerequisites or preadaptations for the tetrapod humerus, but as in every other major transformation

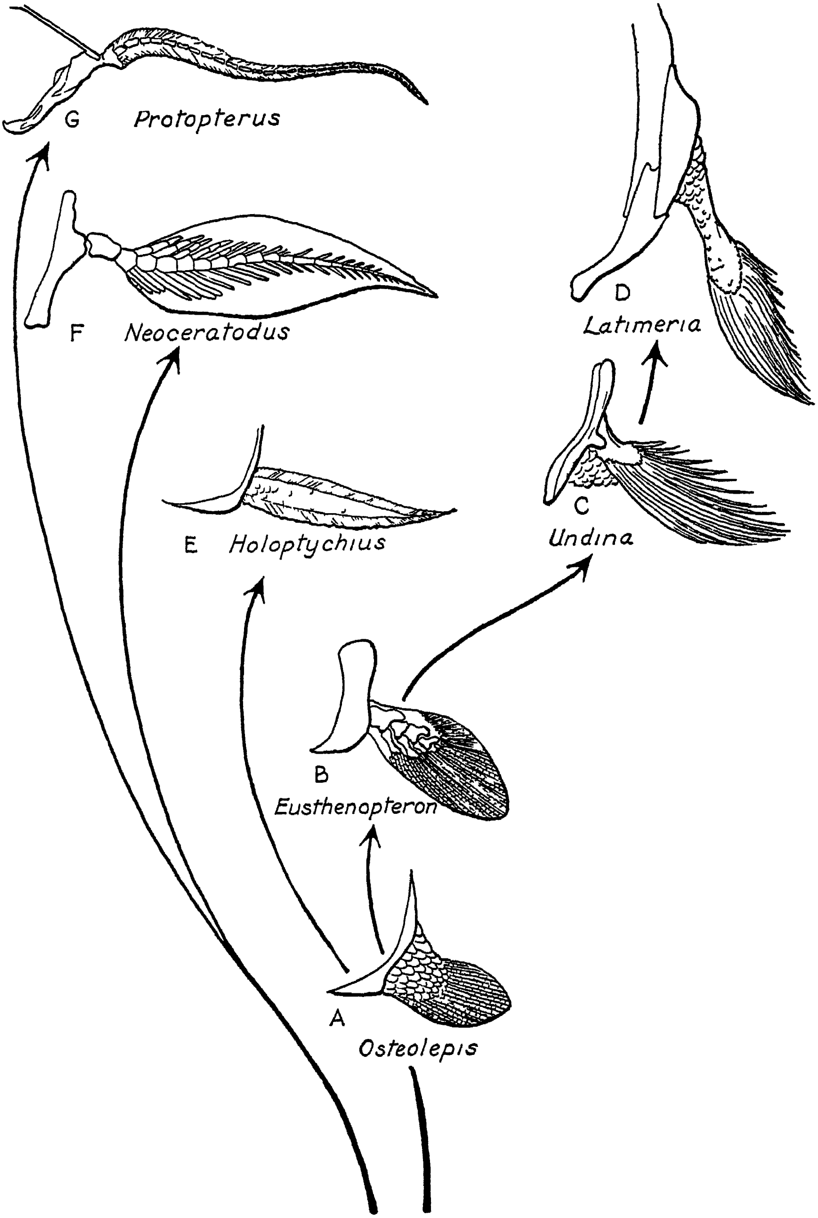


FIG 7. Divergent evolution of lobe fins (crossopterygians) and dipnoans. After Gregory.

there were reductions and losses as well as new gains. That is, all the dermal rays had to be eliminated and possibly one or more of the pre-axial radial branches of the paddle were lost, while from the postaxial, digitiferous border (figs. 8–10) sprouted the second to fifth carpals, metacarpals, and digits (Gregory and Raven, 1941).

THE HUMERUS OF PRIMITIVE TETRAPODS

When the choanate ancestors of the amphibians crawled out and wriggled about on muddy flats, a strong bending of the pectoral paddles, especially between their first and second segments, corresponding to the elbow joint, would permit the more distal part of the paddle to be applied to the substratum (figs. 8–10). Thus the thrusts of the forelimb would help to steer the wriggling of the axial muscles and to raise the ventral surface a little from the ground. That a pectoral fin with a strong muscular lobe can be bent and twisted is seen in the African ganoid fish *Polypterus* which has stout and muscular pectoral paddles. The pectoral musculature, as figured by Klaatsch (1896) was essentially of the cone-in-cone type, that is, an extension of the segmental muscles of the body wall. Although it is uncertain whether or not the metapterygium of *Polypterus* (fig. 5E) is homologous with the humerus of *Eusthenopteron* (fig. 5H), the pectoral musculature of the former suggests a division into a proximal group corresponding to the zono-humeral muscles and a distal group running to the forearm and dermal rays. But this is a matter calling for further investigation.

In some of the early tetrapods, increasing multiplication of axial segments favored the wriggling movements of the body, and the paired limbs remained small or became reduced and disappeared, as in the serpent-like Aistopoda, the Caecilia, and many others. On the other hand, in the lines that led to the typical tetrapods, natural selection evidently favored a genetically determined increase in size, on the ventral side, of the pectoral and coracoid muscles and of the humerus itself. Dorsally a corresponding increase occurred in the scapulo-humeral muscles and in their insertion areas on the humerus.

The pectoral girdle and limbs of fishes are usually situated at or near the widest diameter of the body just behind the gill chamber (fig. 9A). The girdle itself is tied to the skull via the tabular, posttemporal, and supracleithrum. The very large cleithrum bounds

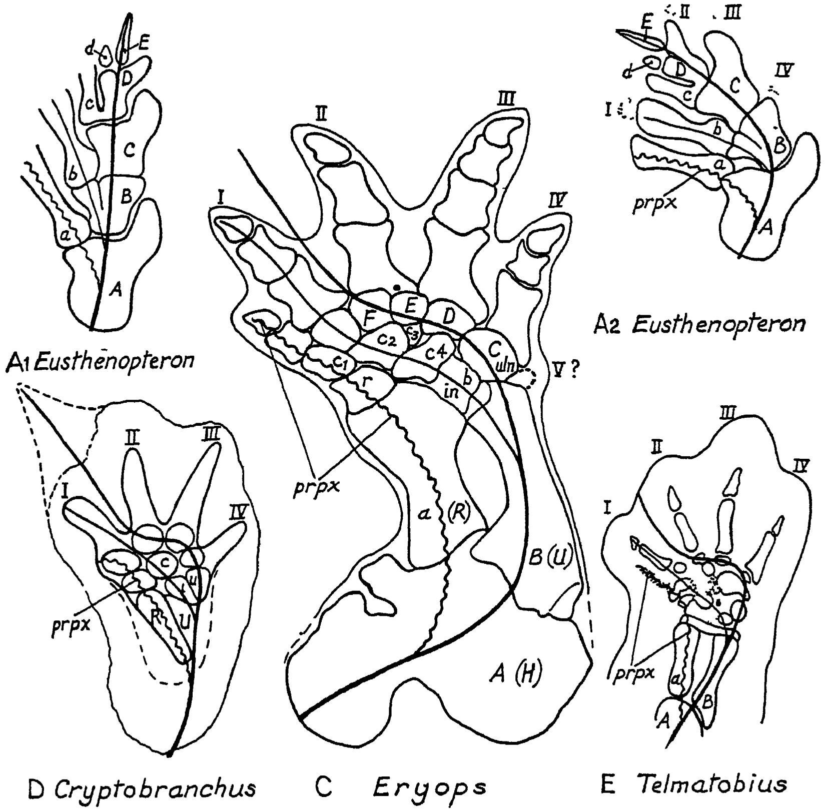


FIG. 8. Skeletal patterns of uplifted pectoral appendages. A1. Devonian lobe fin, indicating humerus (A) in relation to succeeding mesomeres (B–E) and pre-axial radials (a–d). A2. The same, but with sharp flexure at the elbow joint (aB). Dotted areas indicate inferred sites of budding metacarpals. C. Fully developed pectoral appendage of Carboniferous labyrinthodont. D. Pectoral appendage of embryo urodele. E. Pectoral appendage of larval anuran After Gregory.

the gill chambers, affords an anchor for the lateral segmental muscles, and a base for the scapulacoracoid, mesocoracoid, and the pectoral limb. In the early tetrapod *Eogyrinus*, as Watson (1926) has shown, the pectoral girdle was still connected with the skull and the cleithrum was relatively very large. In typical tetrapods (fig. 9C), on the contrary, the connection with the skull is lost, the gill chamber is reduced and retreats to the ventral side, the cleithrum later dwindles to a vestige. The very large scapular blade,

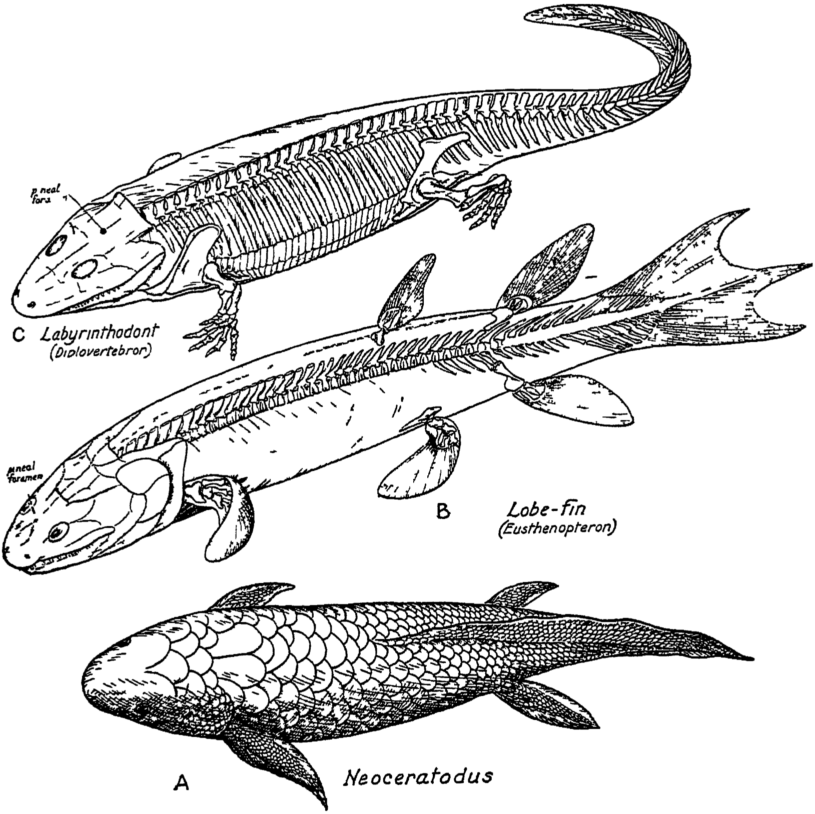


Fig. 9. A. Modern lung fish, oblique dorsal view, showing paired fins After Gregory. B, C. Restorations of the skeletons of Devonian lobe fin (B) and Carboniferous labyrinthodont (C). B modified from Gregory and Raven; C from a model made under the author's direction, with data from Watson.

especially in heavy-bodied forms (fig. 13, A1), has grown far upward; meanwhile the coracoid has expanded and gained a firm base on the enlarged sternum. Thus the pectoral girdle, which arose in fishes as a transverse brace between the skull and the body and as an anchor for the muscles of the flanks, was later transformed into a U-shaped cradle for the support of the body on land, serving also as a base for the expanded and mostly fan-like muscles converging ventrally on the humerus.

Closely correlated changes occurred also in the humerus, as may be seen by comparing the relatively small and simple humeri

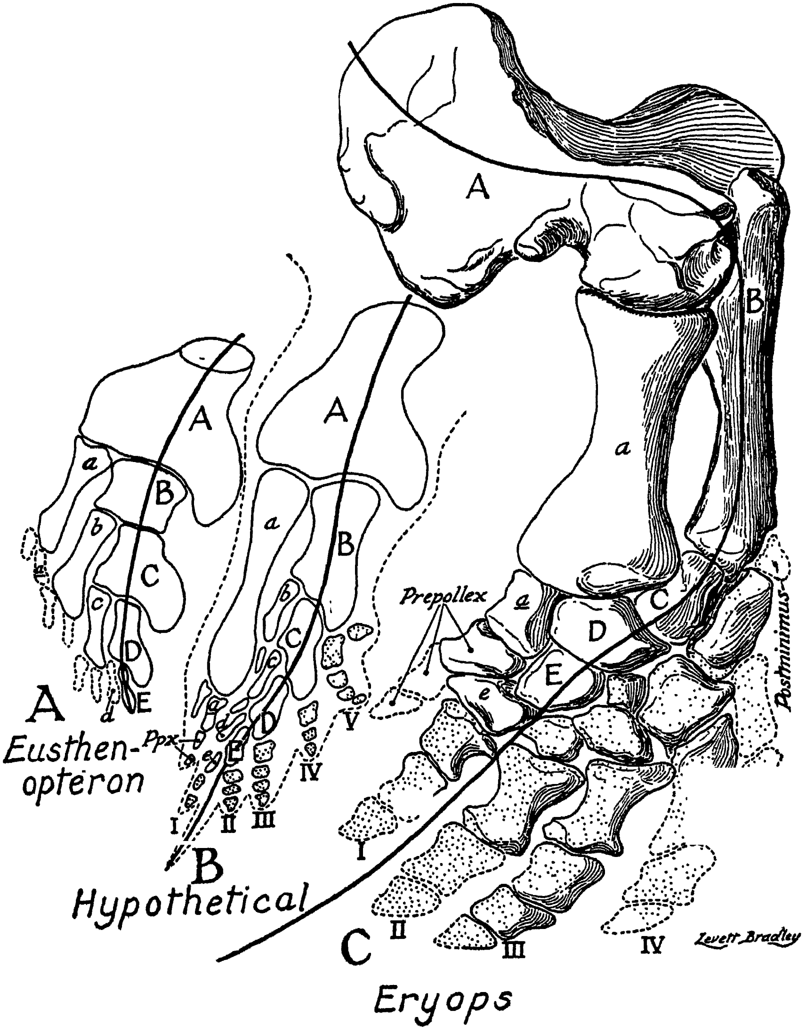


FIG. 10. Skeletal patterns of the pectoral limbs. A. Devonian lobe fin. B. Hypothetical intermediate. C. Permo-Carboniferous labyrinthodont. After Gregory and Raven.

of *Eusthenopteron* (fig. 10A) and *Sauripterus* (fig. 31) with the large and complexly built humeri of *Eryops, Diadectes, Dimetrodon,* and later forms.

Romer (1922, p. 554) showed that in primitive tetrapods the

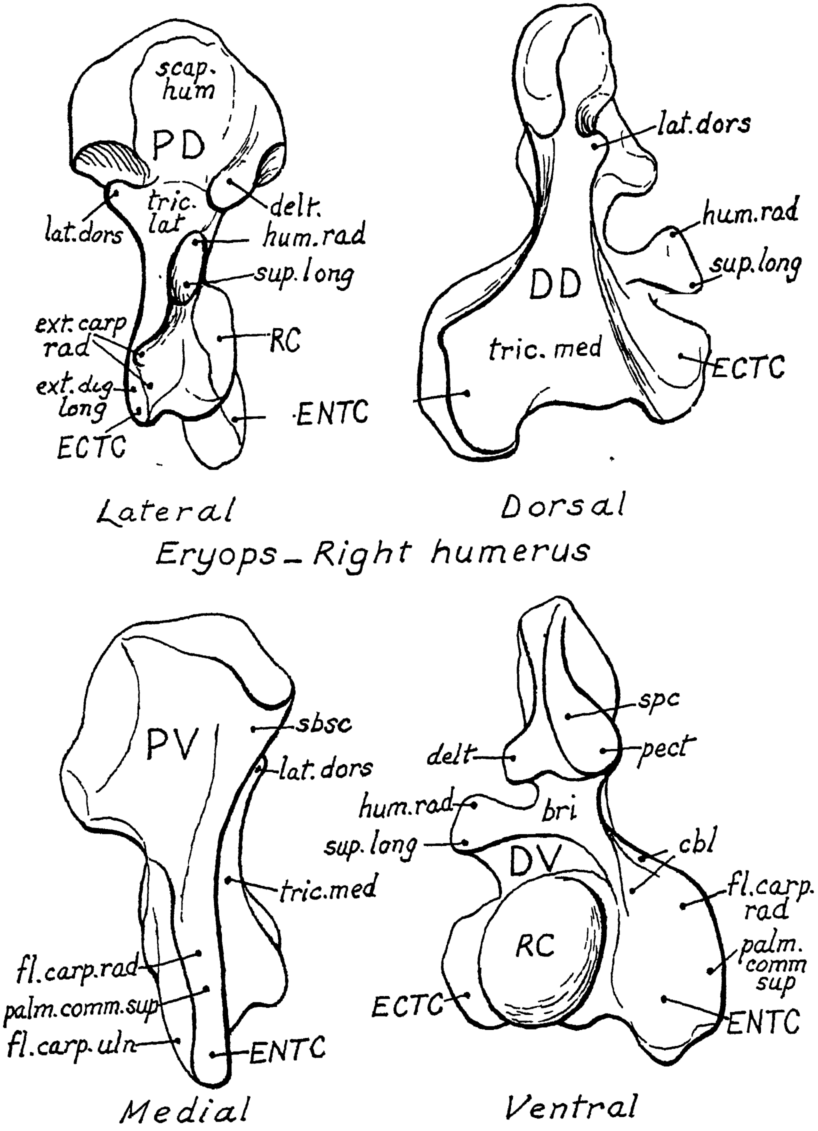


FIG. 11. Four views of the right humerus of a large Permo-Carboniferous labyrinthodont, to illustrate the four "triangular areas" of Romer. Humerus after Miner; triangular areas after Romer; muscle areas after Miner. PD, proximal dorsal; DD, distal dorsal; PV, proximal ventral; DV, distal ventral areas; ECTC, ectepicondylar process; ENTC, entepicondylar process; RC, capitellum for radius.

humerus, with its wide proximal and distal ends nearly at right angles to each other, "was built as a tetrahedron [fig. 11], composed of four roughly triangular surfaces, two having their bases proximally, and two distally, with the planes of these bases at right angles to one another." The tetrahedron is enclosed by four roughly triangular surfaces, respectively, proximal-dorsal (PD), distal-dorsal (DD), proximal-ventral (PV), and distal-ventral (DV). Each of these serves as a triangular truss, and collectively they resist bending moments imposed by muscular force, by weight, and by the reactions of the medium, converging towards the humerus from various directions. In very short humeri of primitive tetrapods (figs. 11, 14, 15) the wide bases and low height of the four humeral triangles reflect the relative thickness and shorter contractile ranges of their respective muscles or muscle groups, while the relatively long shafts of many later humeri (figs. 14, 15, 29) indicate reduced thickness and strength with lengthened contractile ranges. Emphasis of any of the cross sections, crests, or processes implies greater strength of muscles or ligaments and involves changes in their angles of insertion and in the lengths of their lever arms. For example, the very large entocondylar projection in primitive tetrapod humeri (fig. 11, ENTC), together with the shortness of the forearms (fig. 13A), implies (a) corresponding thickness and strength of the pronators and (b) relatively open insertion angles, with directions of pull more nearly at right angles to the shaft of the radius and thus with favorable leverage but short range.

The spirally warped head or proximal articular facet (fig. 11) of the primitive tetrapod humerus permitted partly rolling, partly twisting movement of the humerus under the pull of successive sectors of the fan-like muscles covering the neck and pectoral girdle (Miner, 1925). The capsular and other ligaments must obviously have been so arranged as to permit this rocking and twisting movement.

The primitive tetrapod humerus was adapted for a crawling gait, with sharply everted elbows, wide trackway, and short stride. It is best exemplified in large-bodied labyrinthodonts such as the Permo-Carboniferous *Eryops* (fig. 13A, A1) and in the diadectid division of the Cotylosauria or primitive reptiles. In humeri with lengthy shafts (figs. 14, 15, 29) the proximal and distal humeral triangles recede, and the humerus as a whole assumes somewhat the functions of a loaded beam supported at either end, or more

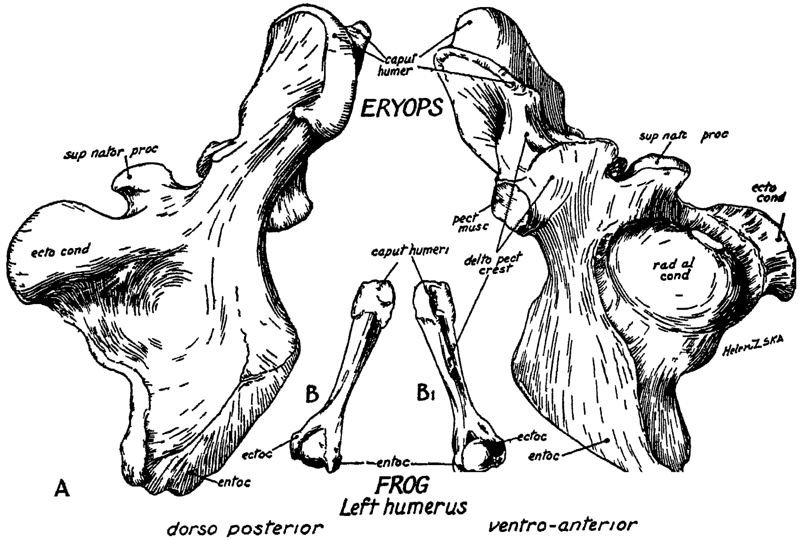


Fig 12 Humeri of primitive tetrapod (A A1) and modern anuran (B, B1) After Gregory

specifically of the boom or jib of a derrick crane (fig. 30) When the head of the humerus (figs. 14, 15, 25) grows towards the dorsal or rear side the upper third of the bone may be bent backward, the lower third forward, producing a more or less sigmoid contour in side view. Strengthening of the bone may occur either by thickening the walls of the more or less hollow shaft or by the presence of old or new crests between the muscle masses Successive cross sections from the surgical neck downward suggest a system of opposed (front and back) triangular struts or trusses (fig. 11).

SURVIVING AMPHIBIA

Among the smaller surviving Amphibia the ends of the humerus often became cartilaginous. In the urodeles (fig 31) the usually small humerus is frequently associated with aquatic habits and with a wide, fan-like expansion of the coracoid cartilage and its muscles. The scapular blade sends forward a large "procoracoid" process which serves as a base for the fan-like supracoracoideus and procoraco-humeralis muscles. Reduction and loss of the cleithrum, clavicle, and interclavicle in these urodeles have contributed to considerable mobility of the right and left halves of the

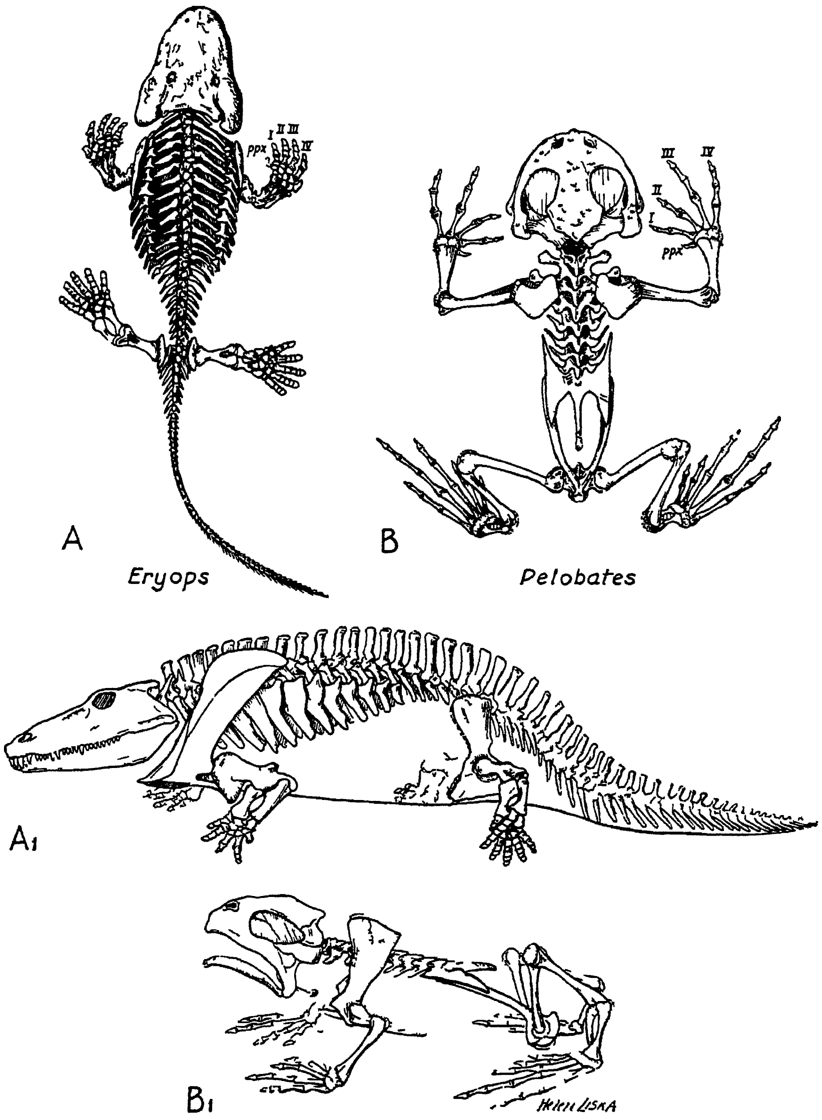


Fig. 13. Skeletons of primitive tetrapod (A, A1) and modern anuran (B, B1). After Gregory.

coracoscapular arch, to a widely swinging movement of the humerus and to a long reach in swimming.

In the frogs and allied forms (fig. 13B, B1) leaping and swim-

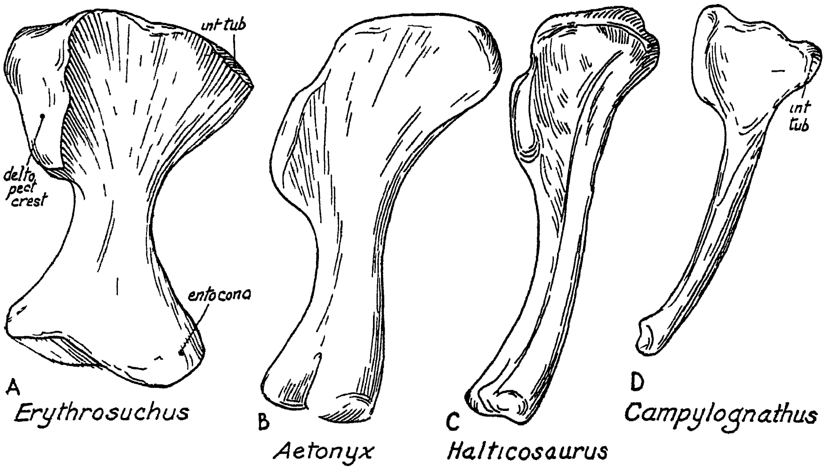


FIG 14 Structural stages illustrating progressive narrowing of distal end of humerus from relatively primitive Triassic thecodont reptile (A) to Jurassic pterosaur From Gregory A, C after von Huene, B after Broom, D from specimen

ming with the hind limbs have been associated with the use of the stout forearms as springs and shock absorbers, and with the consequent strengthening both of the pectoral girdle and of the shaft of the humerus (fig. 12B). The globular capitellum for the radius permits a wide sweep for the forearm, useful also in swimming and grasping.

These and other modern amphibian types branched off from what we may call the "main line," from fish to man, which passed directly from the primitive tetrapod to the central reptilian humerus (fig. 31).

ADAPTIVE DIVERSITY OF THE HUMERUS IN REPTILES AND BIRDS

The humerus of primitive reptiles (figs. 18A, B, 29A) had advanced beyond the primitive tetrapod humerus in the development of an entepicondylar foramen for the median nerve and ulnar interosseous artery (Huntington, 1918). In many forms the formerly warped trackway for articulation with the scapulocoracoid was shortened into a convex head. The primitive reptilian humerus was fundamentally like the humerus of *Sphenodon* (fig. 31) among modern reptiles, but with much wider proximal and distal ends.

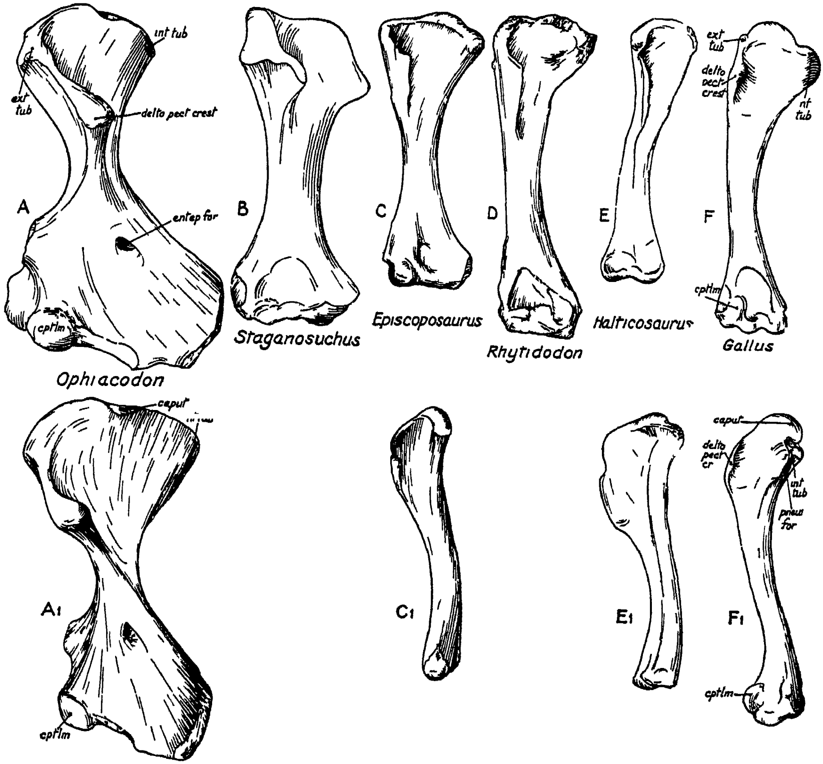


FIG 15 Ventral (A–F) and medial (A1–F1) views of right humeri A Primitive Permo Carboniferous reptile B–E Various Triassic thecodont reptiles F Modern fowl Illustrates progressive lengthening of shaft, reduction of entocondylar process, development and recurvature of convex head From Gregory A after Romer and Price, B C, E after von Huene, D after McGregor F from specimen

Such a humerus is adapted primarily for crawling, plantigrade habits, but it has given rise to many specialized forms, some of which may now be briefly noted

Among the thecodont reptilian stock of Triassic age (fig. 31), which apparently was the source of the aetosaurs, pelycosimians, crocodilians, dinosaurs, pterosaurs, and birds, the pectoral limbs were often smaller than the pelvic limbs and in the humerus of the smaller, less specialized forms, the convex head (caput humeri) was directed upward and somewhat backward (fig. 15C1). In the modern crocodilians (fig. 31), which are a semi-aquatic side branch of the lizard-like thecodont stem, the humerus is fairly long and narrow with somewhat sigmoid curve in side view. The entocondylar process, so large in primitive tetrapods, is here represented only by a low convexity for the lateral ligaments of the elbow. The extensor-supinator crest is low and inconspicuous, and the entire distal end forms a transversely placed rounded capitellum-trochlea. This type of humerus compares rather closely with the humeri of relatively primitive saurischian dinosaurs (fig. 31), and Miner's study (1925) of the muscles and muscle areas of tetrapods gives reliable data for interpreting the homologous muscular areas in dinosaur humeri.

Among bipedal, bird-like dinosaurs the humerus and hand were long and narrow; the humerus of *Struthiomimus* had a long, slender shaft, possibly supporting a patagium. In outer side view the humerus was slightly sigmoid, the distal concavity facing forward.

Increasing massiveness of body led on one side from the primitive Triassic thecodonts to the huge, bipedal, flesh-eating dinosaurs, eventually with small hands and short humeri (fig. 31), and on the other to the ponderous, secondarily quadrupedal Sauropoda. The latter had very large humeri with a wide fossa for the thick coraco-brachial muscles, and massive deltopectoral ridge (fig. 31). The distal epiphysis was long-growing and partly cartilaginous. The distal position of the large, radio-ulnar facet permitted a marked opening of the humero-radial angle, useful in walking under water.

The beaked dinosaurs or Ornithischia, which had advanced herbivorous jaws and teeth, were also secondarily quadrupedal and their ungual phalanges bore flat nails. Among them the duck-bill and cassowary-like dinosaurs were semi-aquatic, the fingers partly webbed; their humeri in side view were slightly sigmoid but not notably specialized. In the ponderous quadrupedal ceratopsians, on the other hand, the humeri were very massive (fig. 31) with large proximal crests and sharply bent elbows for the support of the enormous skull. The sharply projecting entocondylar convexity of the early tetrapod humerus had long since been reduced in the small bipedal running ancestors of these huge animals, but with increasing weight the proximal and distal ends of the humerus were secondarily widened and thickened, and the massive distal end was probably tied to the huge ulna and radius by very large and strong ligaments and by thick

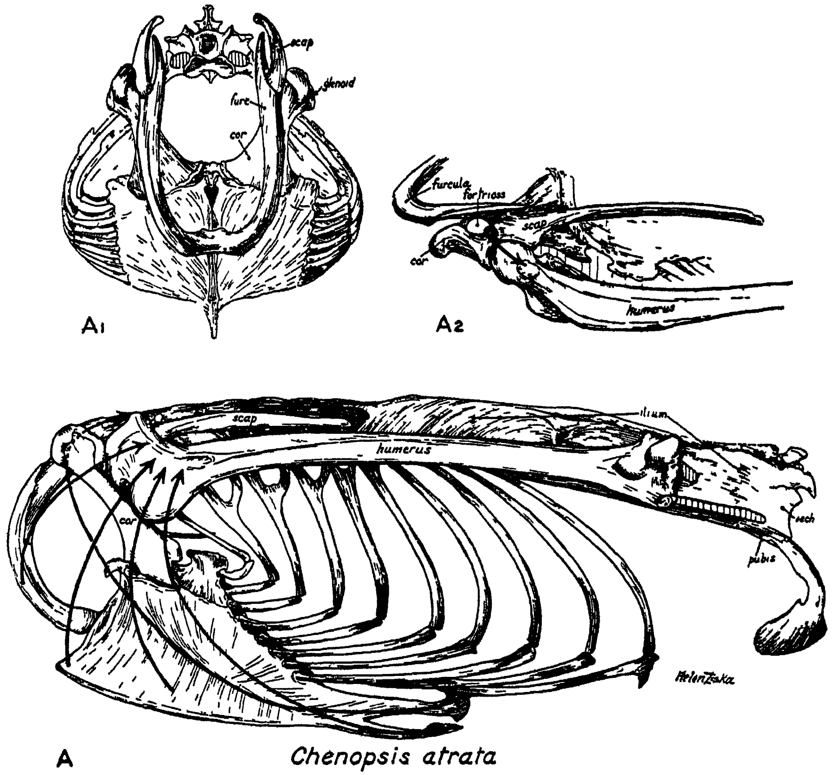


FIG. 16. Humerus, pectoral girdle, and axial skeleton in a bird of strong flight. Showing stiffening of backbone, strong development of sternum, furcula, coracoid, spring-like ribs The large deltopectoral crest flares out near the proximal end of the columnar humeral shaft. The forward and upward movement of the wing is effected in part by the deep pectoralis minor, the downward movement by the pectoralis major. From specimens.

muscles of great power. Still shorter and relatively wider were the humeri of the armadillo-like ankylosaurs. In brief, humeri of primitive dinosaurs, starting from the small, rather weak humeri of the Triassic thecodonts gave rise to: (1) the very long humerus of *Struthiomimus* with its almost cylindrical shaft and small tuberosities; (2) the long but enormous humeri of certain sauropods (e.g., *Brachiosaurus*); and (3) the extremely massive, wide humeri of the later Ceratopsia and Ankylosauria.

In quadrupeds the length of the humerus is obviously one of the several factors in the length of the stride. The long humerus of

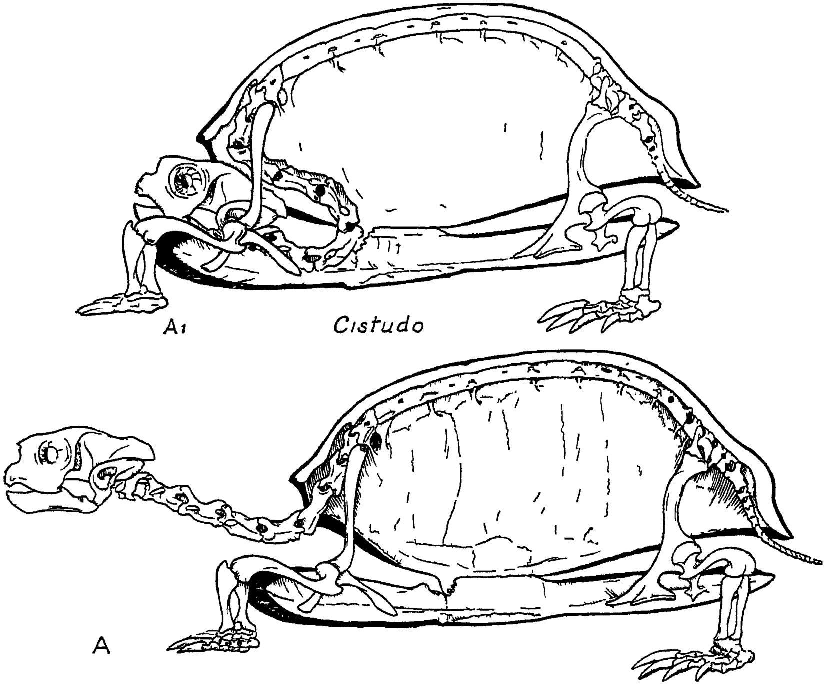


FIG 17 Skeleton and half section of box tortoise, to show partial enclosure of girdles and limbs by overgrowth of carapace and plastron From specimens.

climbing animals contributes to the long reach and must withstand relatively great tensile stresses due to weight.

Among the bat-like pterosaurs the shaft of the humerus (fig. 14D, 31) was narrow with thin walls and pneumatic interior. In side view the bone was curved anteroventrally, and there were a high delto-pectoral crest and large coraco-brachialis fossa. The joint at the narrow distal end was more or less hinge-like

The long humerus (fig. 16) of birds of strong flight has a large oval head facing dorsocaudally, a fairly large internal tuberosity, and a pneumatic interior. Thus the avian humerus, as compared with the central reptilian type, has undergone much less change than has the avian pectoral girdle, in which the sternum has gained a huge base and a high median keel (fig. 16). The humeri of ratite birds is longest in *Rhea* and becomes very small in emus, cassowaries, and *Apteryx*, i.e., as the wings degenerate. The pectoral limb of penguins (fig. 31) has become paddle-like, but

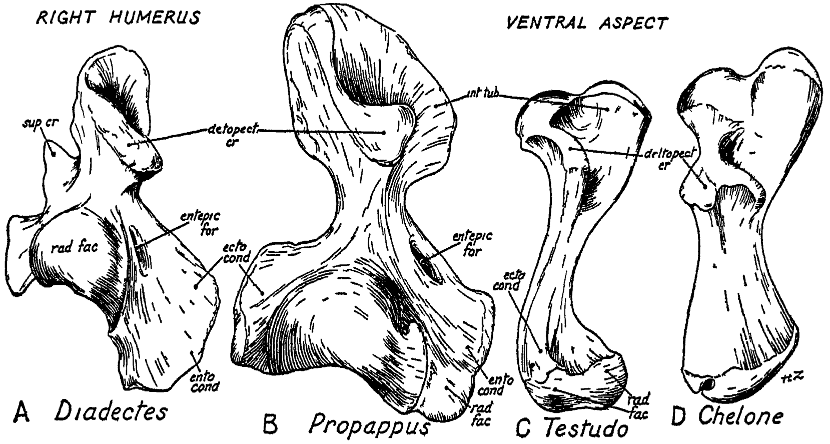


FIG 18 Comparative series of humeri from primitive reptile (A) to modern sea turtle (D) After Gregory

the elements of the avian wing are still present, though highly modified (Simpson, 1946).

The marked sigmoid curve of the tortoise humerus (figs. 17, 18), together with the globular, backwardly directed head, permits the humerus to be swung either far forward, so that the elbow looks like a knee (fig 17), or far backward to enable the pectoral limb to be tucked under the overhanging marginal ridge of the carapace In spite of its specialization the humerus of the tortoise (fig. 18C) is foreshadowed in basic features by the humerus of pareiasaurs (fig. 18B), which in turn are readily derivable from the primitive tetrapod type retained in diadectid cotylosaurs (fig. 18A). The very peculiar humerus of the sea turtle (fig. 18D) forms part of a pectoral paddle or wing, it is flattened, the distal end widened, the deltopectoral crest much modified, and the medial tuberosity greatly enlarged and flattened

In ichthyosaurs (fig 31) the limbs have become completely paddle-like, the humerus was flattened, with wide distal ends, and the rest of the limb has changed into more or less polygonal secondary polyisomeres. The humerus of ichthyosaurs may have been derived from the slender, semi-aquatic humerus of *Mesosaurus*. The humerus of plesiosaurs (fig. 19E, F) is closely connected with that of nothosaurs (fig. 19C) which, in turn, lead backward towards a *Sphenodon*-like type (fig. 19A, B). As in other advanced aquatic reptiles the facet for the ulna is shifted to

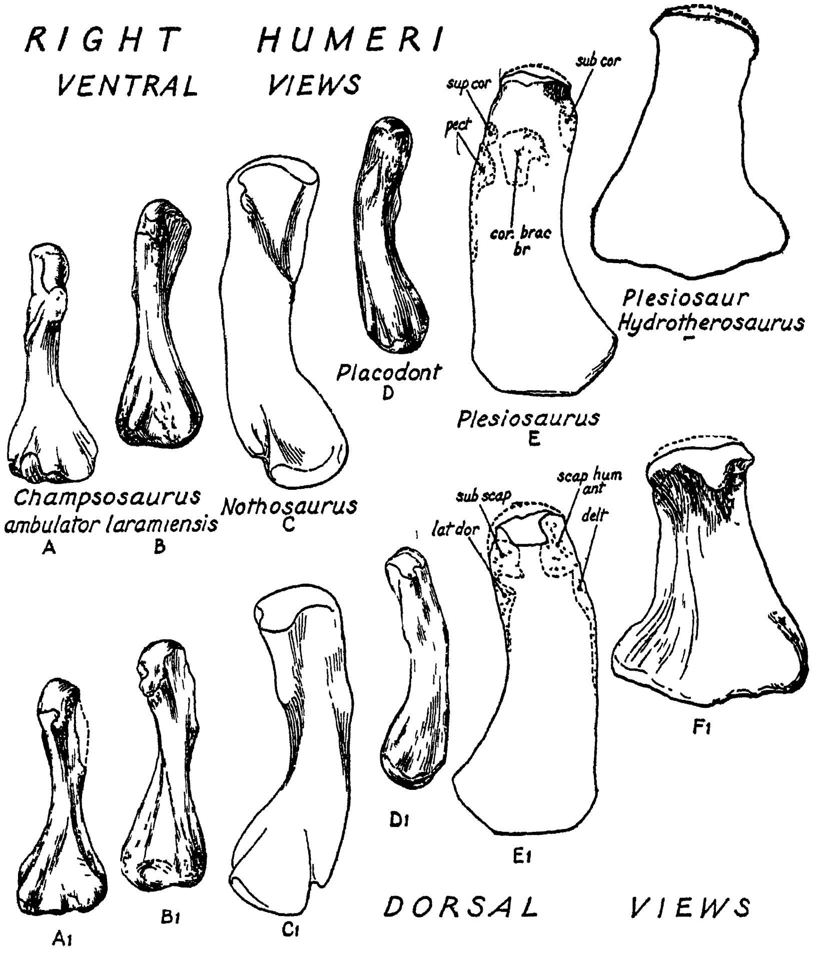


FIG 19. Comparative series of reptilian humeri; from relatively primitive semi-aquatic form (A, B) to highly specialized marine plesiosaur (F). From Gregory. A, B after Barnum Brown; C, D after von Meyer; E after Watson; F after Wells.

the outer side of the distal end of the humerus so that the olecranal process is lateral to, not behind, the head of the radius, both radius and ulna being flattened into the same plane.

RISE AND DIVERSITY OF THE MAMMALIAN HUMERUS

Returning to the "main line," in the earlier mammal-like reptiles, the humerus of the less specialized pelycosaurs (fig. 29A) retained a large entocondylar process and was not very different from the primitive tetrapod type in being adapted for a crawling gait. In the giant South African dinocephalians the pectoral girdles and humeri were relatively primitive, although the elbow in standing was less sharply bent and everted than in the primitive tetrapod. For the support of the great body weight the coracobrachialis brevis muscle and its fossa were widely expanded, as well as the areas for the extensors (Romer, 1922, pl. 36). In the gorgonopsians the fairly primitive humerus (fig. 29B), with its moderate sigmoid curve, permitted a somewhat cat-like stride with the body raised well off the ground (Colbert, 1948), with elbows less everted than in primitive tetrapods. In the cynodonts the pectoral girdle approached the mammalian stage especially in the scapula and coracoid, and so also did the humerus (fig. 29C).

Simpson (1928, p. 155) has shown that in the humerus of the cynodont *Diademodon* (fig. 20A) the convex head was directed dorsoposteriorly but was not spherical, and the deltopectoral crest at its proximal end was not yet expanded into a distinct greater tuberosity, although the lesser tuberosity was well developed. A large entepicondylar foramen was retained as well as an ectepicondylar foramen, both being characteristic of reptiles. The deltopectoral crest had begun to be turned medially towards the fossa for the coracobrachialis brevis and biceps muscles.

Among the Tritylodontoidea the humerus (fig. 31) is well shown in *Bienotherium* from the upper Triassic of China (Young, 1947, p. 582). This genus may represent an early side branch of the mammalian Order Multituberculata. Its skull and jaws were advanced beyond the cynodont stage and were almost mammalian. The descriptively multituberculate molars were adapted for crushing hard objects. The humerus closely approaches the primitive mammalian type, but the upper end of the deltoid crest, although it is already raised into a swollen great tuberosity, is continuous with the head, which is not so fully spherical as in typical mammals. There are a large entepicondylar bridge and foramen, and there may be also an ectepicondylar groove.

Among the Jurassic mammals the humerus is known only from three specimens of uncertain ordinal position. As described by Simpson (1928, pp. 155–159) they retained many cynodont features, but in others, such as the nearly spherical head, they were more mammalian (fig. 20B). However, after careful com-

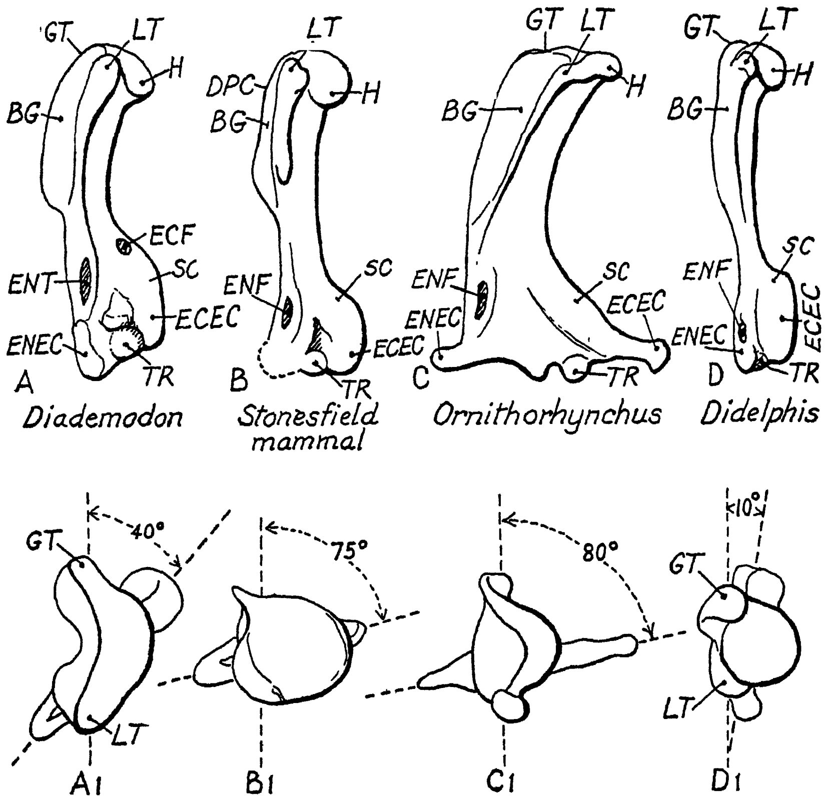


FIG. 20. Median posterior view of right humeri. After Simpson. BG, bicipital groove; DPC, deltopectoral crest; ECEC, ectepicondyle; ECF, ectepicondylar foramen; ENEC, entepicondyle; ENF, entepicondylar foramen; GT, greater tuberosity; H, head; LT, lesser tuberosity; OF, olecranon fossa; SC, supinator crest; TR, trochlea. A1–D1. Proximal views. Not to scale.

parative studies Simpson (*op. cit.*) concludes that these humeri were normally held in a nearly horizontal plane as in cynodonts and monotremes. "The radial and ulnar articulations [of the Stonesfield mammal]," writes Simpson (*op. cit.*, p. 156), "are also extraordinarily reptilian. The true sharp-crested trochlea of later mammals is not well developed. The radius articulates on a separate rounded surface external and somewhat ventral to the ulnar articulation."

The humerus (fig. 20C) of the monotreme *Ornithorhynchus* at first sight recalls that of primitive reptiles, but as Simpson (*op.*

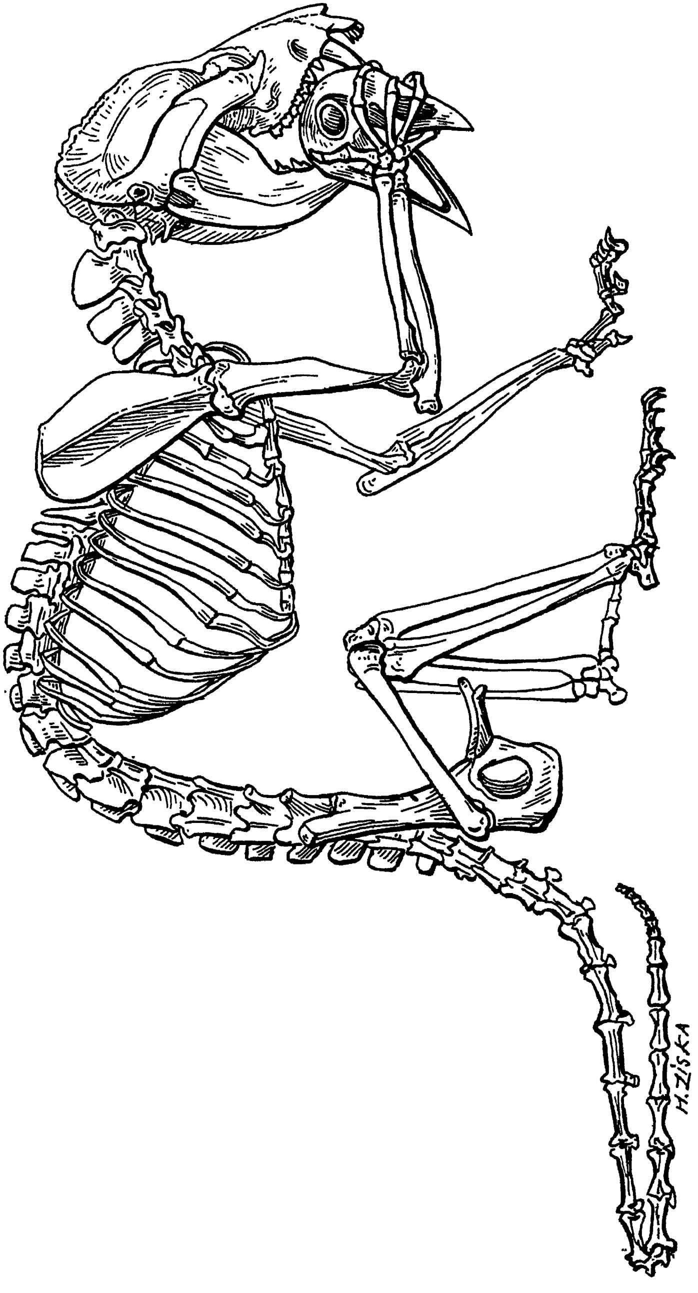


FIG. 21. Skeleton of American opossum, mounted by S. H. Chubb. From Gregory.

cit.) and Howell (1937a) have shown, it is specialized for both digging and swimming. In the pectoral girdle the dorsoposterior border of the scapula is prolonged backward while the prespinous fossa is either vestigial or incipient. The thin, plate-like epicoracoid slides a little on the expanded sternum and strong interclavicle. Although these may be partly habitus features, the girdle of *Ornithorhynchus* as a whole strongly recalls the conditions in *Cynognathus* and indicates that also in the humerus the basic features have been inherited from a remote cynodont ancestor, although the extreme projection of both the entepicondylar and extepicondylar processes (fig. 20C) together with the concavely curved head (fig. 20C1) may be later specializations.

The wide humerus (fig. 22B) of *Tachyglossus* ("*Echidna*") clearly reflects great strength in digging, as do also the block-like coracoid, the well-braced interclavicle, and stout sternum.

According to Simpson (1928, pp. 156–158), in the humerus (fig. 20D) of the opossum *Didelphis* the plane of the distal end diverges only about 10 degrees from that of the proximal end (drawn through the greater and lesser tuberosities), whereas in the Stonesfield humerus (fig. 20B1) of a Jurassic mammal the corresponding angle is about 75 degrees and in *Diademodon* only 40 degrees. This accords with much other evidence that, as we pass from early tetrapods to mammals, the angle between the proximal and distal ends of the humerus approaches zero. This is no doubt associated with the drawing inward of the elbows and opening of the angle at the elbow as in typical mammals.

The humerus of *Didelphis* (figs. 21, 22) also is typically mammalian in possessing a distinct lateral or greater tuberosity on top of the deltoid crest. Upon it are inserted both the supraspinatus and infraspinatus muscles, which are pretty certainly derived from the supracoracoscapula muscles of reptiles (Romer, 1922, p. 594). Likewise an internal or medial tuberosity was present, to which was attached the subscapularis muscle. The "mammalian" posture of the humeri of *Didelphis*, with the elbow almost immediately beneath the caput humeri, is made possible not only by the various mammalian features of the humerus itself, but (1) by the freeing of the reduced coracoid from direct contact with the sternum, (2) by the wide mobility of the whole complex of clavicle, coracoid, acromion, scapula, and humerus around the sternal articulation of the clavicle, and (3) by the protection afforded to the shoulder joint by the overhanging acromion and its ligaments.

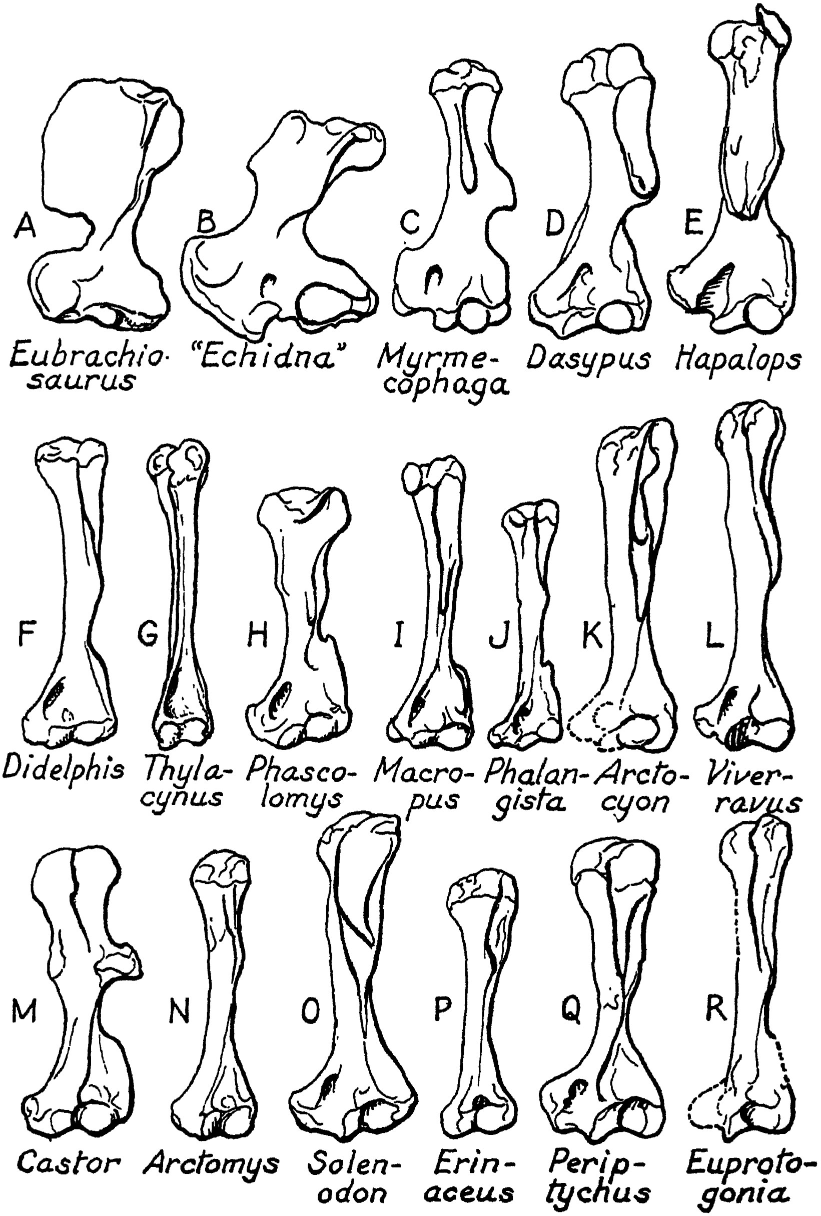


FIG. 22. Left humeri of various primitive and adaptive types. From Gregory. A after Williston; E after Scott; others from the American Museum of Natural History collections.

Doubtless the moving outward of the shoulder joint away from the midline exposed it to greater danger from breakage in falling, but the resulting mobility, the wider reach and swing of the forelimb, contributed much to the increased speed, effectiveness, and endurance of mammalian over reptilian locomotion. The *Didelphis* pattern of pectoral girdle and humerus appears to be archetypical to that of all other marsupials.

In the "marsupial wolf" (*Thylacynus*) the marked elongation of the humerus (fig. 22) has helped to lengthen the stride of this cursorial predator. The entepicondylar and ectepicondylar projections were much reduced. The distal facet indicates a chiefly hinge-like movement at the elbow, with limited supination.

At the other adaptive extreme, in the humerus of the "marsupial mole" (*Notoryctes*), digging powers are indicated by the marked widening of the distal end, by the strength of the crests, and by the winding surface for the brachioradialis.

Among the diprotodont marsupials the phalanger humerus (fig. 22J, *Phalangista*) is close to the didelphid type, but with some increase of the supinator-extensor crest. The humerus (fig. 22) of the wombat (*Phascolomys*), a powerful digger, is evidently derived from the phalanger type, but it has become stouter, distally wider, with projecting tuberosities and crests. On the whole there is a certain convergent resemblance to the cynodont humerus (fig. 29C), but the head is more spherical and the distal end completely mammalian.

The humerus (fig. 23) of the giant herbivorous *Diprotodon* and related genera is associated with a very peculiar form of scapula in which there is a large, cap-like, dorsal protuberance directly above the vertical scapular spine. To this may have been attached a thick dorsoscapular ligament, while below it was the serratus anterior muscle, supporting the massive body. The vertebral border of the scapula is extended far downward, and the axial margin is greatly reduced. The inferior angle ends in a prominent, downwardly projecting tuberosity, possibly for a robust teres minor. Perhaps in correlation with these and other features the ulna has an enormous, transversely widened olecranon for the triceps, and the middle of the lateral aspect of the humerus bears a prominent, laterally projecting process and rugosity, probably for the deltoid muscle. In short the humerus of *Diprotodon* as compared with the primitive phalanger type, in becoming gigantic and graviportal, has on the whole been simplified.

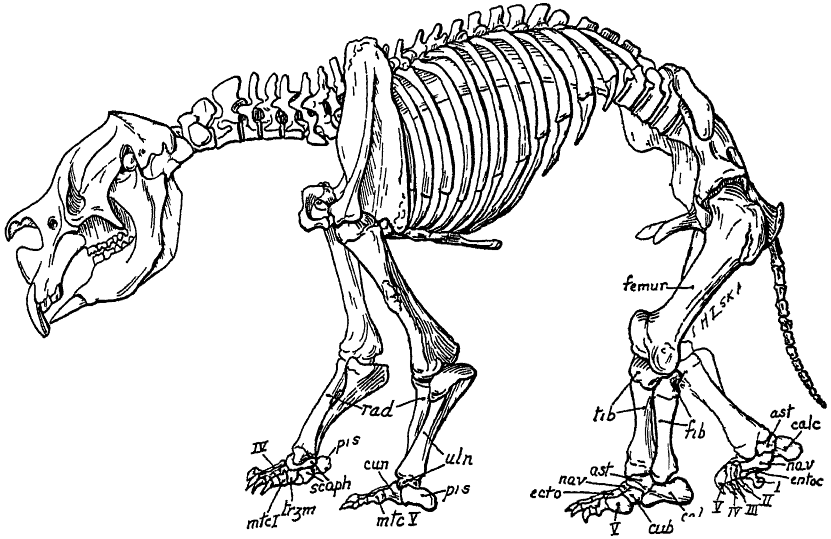


Fig 23 Skeleton of *Diprotodon* From Gregory

Among the placental mammals adaptive branching was already prolific in the Paleocene and Lower Eocene epochs, and there were many lines that subsequently became extinct as well as a few that branched in later times Matthew (1904, 1937) showed that the known hands and feet of Paleocene and early Eocene placental families were pentadactylate, with spreading digits and partly divergent pollex and hallux, respectively, also that the radius and ulna could be freely supinated. He regarded these and correlative characteristics of the girdles, limbs, and vertebrae as indicating for the placental mammals arboreal ancestry, as already had been held to be so in marsupials by Dollo (1899) and by Bensley (1901)

The humeri of the smaller Paleocene and Lower Eocene placental mammals, so far as known, were of the same basic pattern as the opossum humerus (fig. 22F), but the extensor-supinator crest (fig. 22K, L, O) was less flaring at the upper or proximal end. It sloped evenly towards the shaft of the bone and did not end above in a sharp notch. At the distal end the capitellum is less spherical in front view than it is in *Didelphis* (fig 22F), and the trochlea often has a sharp inner keel extending distally below the level of the capitellum. In the living *Gymnura* (fig. 31), a fairly primitive

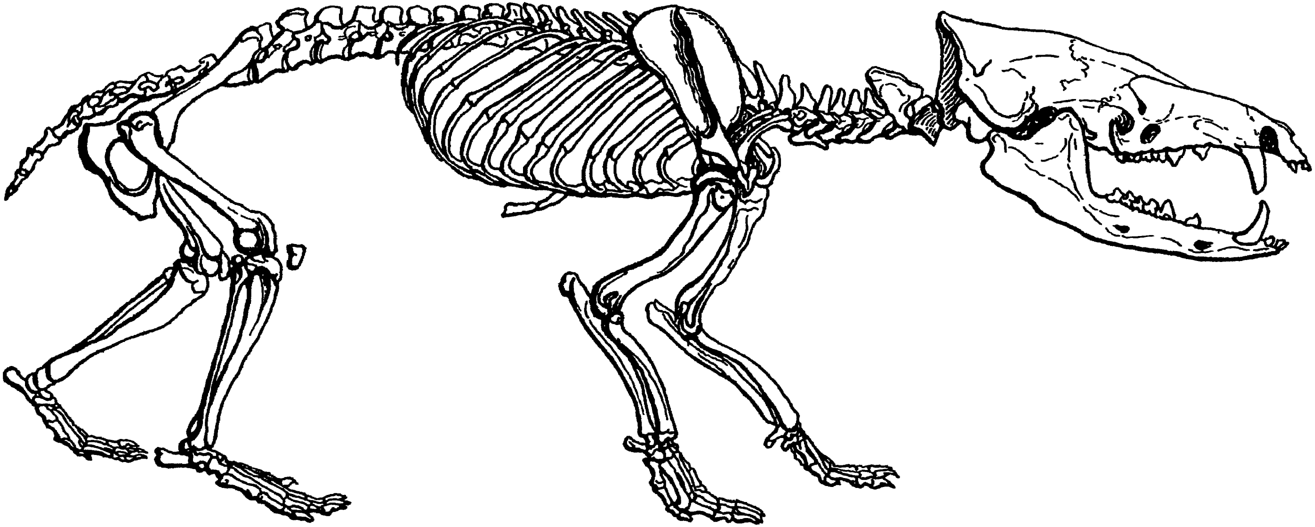


FIG 24 Skeleton *Ce* From Grego De Blainville

insectivore, as well as in *Centetes* (fig. 24), this kind of elbow joint is associated with a transverse widening of the head of the radius, which extends across to, and even a little beyond, the inner keel of the trochlea. With such a joint only a moderate supination of the radius is possible, and this condition predominates among both fast running and digging mammals. And among the primitive Paleocene and Lower Eocene placentals (except possibly *Nothodectes*) there is little or no suggestion of the "outer lip" of the trochlea (figs. 25, 28) which is developed in arboreal Primates (Gregory, 1920, p. 71; Simpson, 1935, p. 13).

A review of the skeletons of Paleocene and Lower Eocene mammals suggests that these early placentals were nearer to ground-living, unguiculate, semi-fossorial ancestors than they were to a more remote arboreal stock (fig. 31). Advanced fossorial habitus was already attained in the mole-like Paleocene humerus (fig. 31) described by Simpson (1937, p. 140). This further indicates a fairly long antecedent history of partly ground-living habits for the placentals, extending well back into the Upper Cretaceous. As noted above the only known mammalian humeri of the Triassic (fig. 31) and Jurassic (fig. 20B) ages tend to connect the marsupials with the cynodont stock, and the detailed characters of the Stonesfield humerus indicate normally horizontal posture with elbows widely everted (Simpson, 1928). Such a combination may have been useful in a partly climbing, partly digging, ambulatory stage, ancestral to the known diversified Paleocene humeri.

With increasing speed and lengthening stride the humerus may become either relatively long and narrow as in the dog (fig. 31), or short and thick (when the power is concentrated in the proximal segment) as in the horse (fig. 31) and other fast cursorial herbivores. The elbow joint also becomes quite hinge-like, and the movement is limited to extension and flexion. Especially in massive, heavy-bodied mammals, the entocondylar eminence is often pronounced, indicating very strong ligaments. The deltopectoral crest is usually prominent, and so also are the winding surface for the brachialis inferior muscle and the extensor-supinator crest.

In heavy-bodied ungulates which have large scapulae and heavy shoulder muscles the great tuberosity of the humerus sometimes becomes very large and high, especially in elephants, titanotheres, and horses (fig. 31).

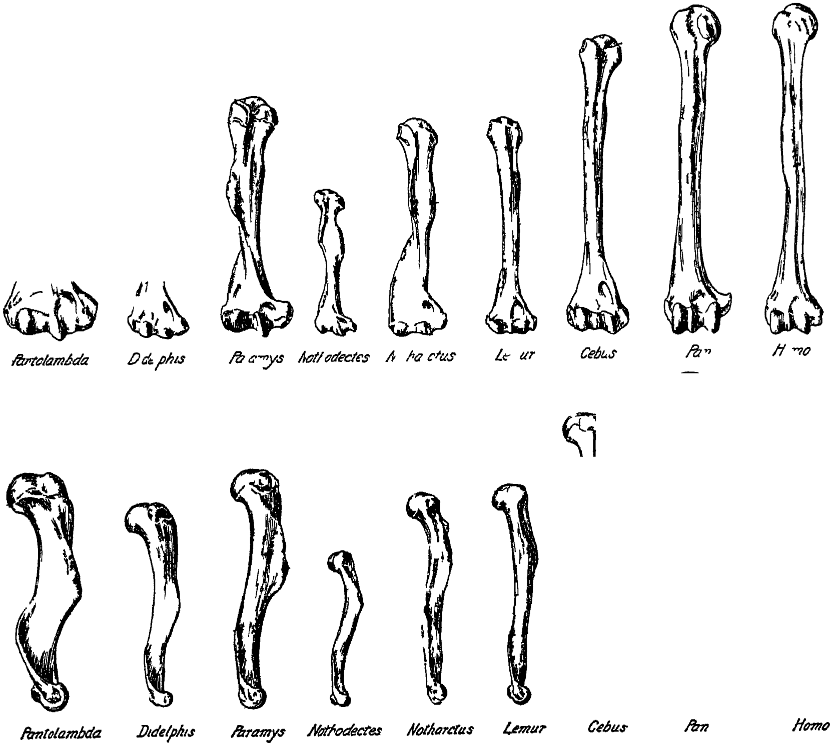


FIG 25 Humeri of primitive placental mammals and primates. After Gregory

In digging types, the more or less sigmoid curve of the humerus, as seen from either side (fig. 25), is probably associated in part with a markedly spiral brachialis channel, but it may also serve to shorten the humerus, thus lessening adverse leverage and making it easier to turn around in a narrow tunnel. This sigmoid flexure is also pronounced in swimmers such as otters and seals.

The somewhat sigmoid humerus of the manatee and other sirenians is short, with pronounced deltopectoral crest. The elbow joint is rather hinge-like. The whole bone is excessively dense and heavy as are also the ribs.

In cetaceans, whose entire pectoral limb has been changed into a flipper, the humerus, radius, and ulna are flattened, the humerus is distally widened, while the phalanges are multiplied, recalling the conditions in pleisiosaurs. Among the most specialized

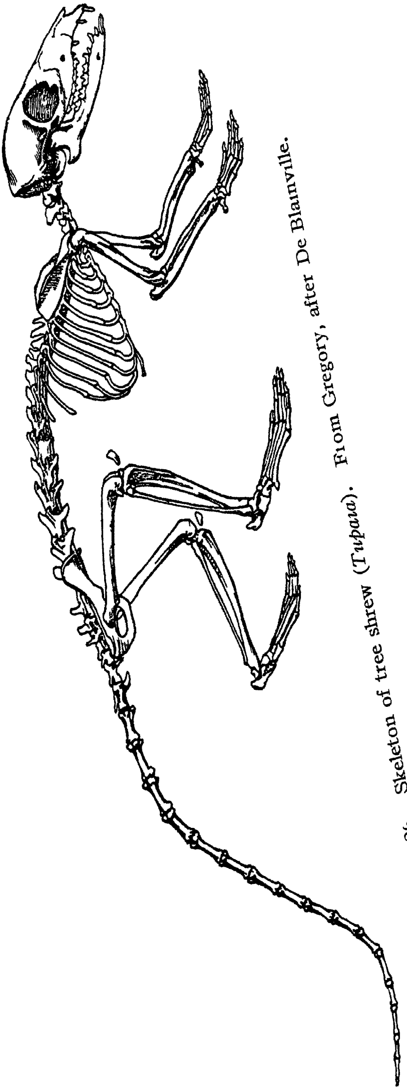


FIG. 26 Skeleton of tree shrew (*Tupaia*). From Gregory, after De Blainville.

cetacean humeri is the humerus of *Eubalaena* (fig. 31) with extremely short shaft, huge spherical head, wide distal end, and small antero-internal tuberosity, possibly for the mastohumeralis muscle (cf. Schulte, 1916).

The very long, somewhat cylindrical humeri of "flying lemurs" (cobegos) are sufficiently strong to resist the bending moments imposed by the weight of the body in skimming through the air and landing, and by the pulls of the long extensors and flexors. The cylindrical radius is much larger than the splint-like ulna which is coalesced distally with the radius. Thus the movement at the elbow is largely hinge-like, as indicated also by the widened head of the radius. In the fruit bats, the humerus (fig. 31) is also very long and slender. In the Microchiroptera two processes, one on either side of the head of the humerus, sometimes articulate with the scapulo-coracoid, thus limiting the movement, but increasing the strength, of the joint (Miller, 1907). Doubtless the associated ligaments must be relatively strong.

THE HUMERUS FROM TREE SHREW TO MAN

The Recent and extinct "tree shrews" (Tupaioidea) although long classed with the Insectivora agree with or approach the lemurs in many significant structural features (cf. Gregory, 1910, pp. 269–285) and have been transferred to the lemuroid primates by recent authors (cf. Simpson, 1945, pp. 61, 176). In the Recent *Tupaia* the humerus (figs. 26, 32) and the forearm are both long and slender, and the radius is about as long as the humerus. The head of the humerus is large and spherical, the great tuberosity low, and so is the deltoid crest. The bicipital groove is barely indicated, the extensor-supinator crest small, an entepicondylar foramen is present. The entocondylar eminence is conspicuous, indicating thick tendons of the pronator and flexor muscles. The capitellum is relatively large and globular, the head of the radius subcircular on the medial side. The trochlea is relatively small and, except perhaps in extreme flexure, the small coronoid process of the ulna seems to have little share in the front face of the trochlea, which in the front view is in contact solely with the radius. Nevertheless, moderate, though not extreme, supination seems possible, as is indicated by the short, spreading hands with compressed, curved, pointed claws and well-developed, partly divergent pollex.

All these and other features may be preadaptations for arboreal

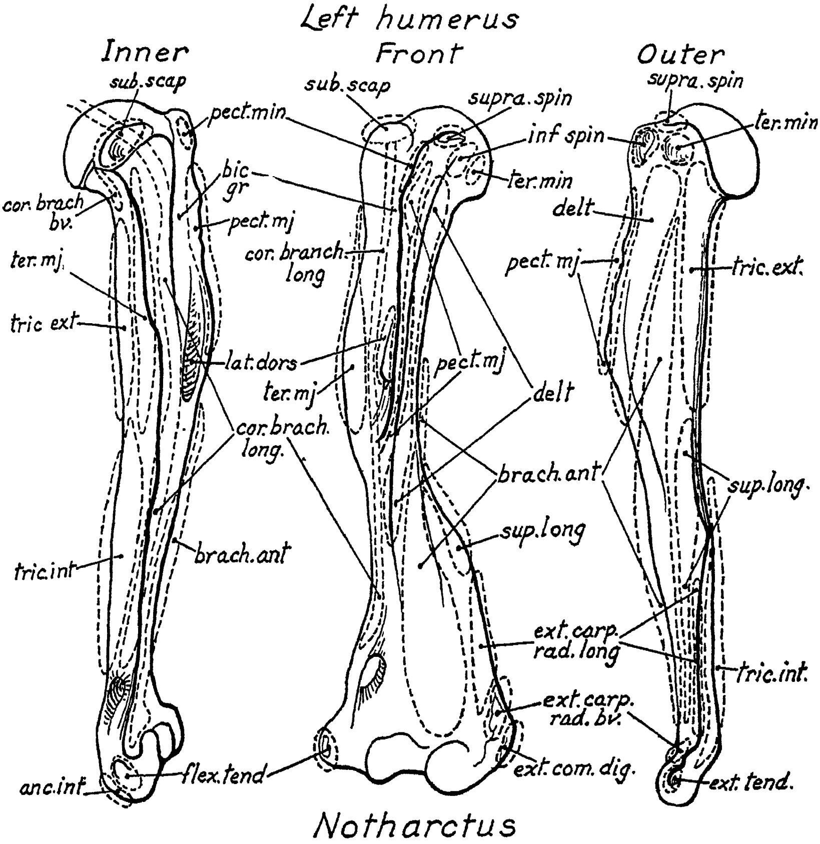


FIG. 27. Humerus of *Notharctus* with muscle areas inferred from those of recent lemurs. After Gregory.

life rather than completed arboreal adaptations, especially since but few of the numerous species of tree shrews are truly arboreal, most of them apparently living on the ground among the roots of trees or on low bushes (Lyon, 1913, p. 21). But there is no doubt that certain species (*ibid.*, p. 57), and especially the pen-tailed tree shrew (*Ptilocercus lowi*) of Borneo, are arboreal.

The Paleocene family of Plesiadapidae, long regarded as a member of the Order Insectivora, was referred to the tree shrew group by Matthew (1915). The humerus (fig. 25) of "*Nothodectes*" (= *Plesiadapis*) seems indeed to afford a structural stage leading from semi-terrestrial to the fully arboreal habitus of the Eocene and Recent lemuroids. The humerus of *Nothodectes* was relatively shorter and wider distally than that of *Ptilocercus* (Gregory, 1920, p. 70, pl. 27), and its more strongly developed crests and process suggest a stronger, probably ground-living type. Simpson (1935) during a careful analysis of the morphological characters of the *Plesiadapis* ("*Nothodectes*") skull, dentition, vertebrae, scapula, humerus, radius, etc., referred the Tupaioidea, including *Plesiadapis* and the tree shrews, to the Suborder Lemuroidea.

In *Notharctus*, a quite primitive Eocene lemur, the humerus (fig. 25) somewhat resembles the climbing opossum type (figs. 21, 22) especially in its large extensor-supinator crest (fig. 27). But the opossum has a relatively short, well-clawed hand and comparatively strong flexor muscles, whereas in *Notharctus* the whole arm and hand was long and slender, with thin fingers and weak flexors of the digits; it also had nails, not claws. Here, as in many other cases, two mammals with very different kinds of hands, conforming to different locomotor habits, may have less distinctly dissimilar humeri.

The *Notharctus* type of humerus (figs. 25, 28) was evidently well fitted to give rise by minor successive changes to the diverse humeri of later lemuroids and monkeys and eventually to those of apes and man. The humerus of *Tarsius* appears to be a specialized derivative of the *Plesiadapis-Notharctus* stem (Gregory, 1920, p. 75).

The humeri of New World monkeys (fig. 28) often retain an entepicondylar foramen, but their shafts are thinner than in *Notharctus*, and the supinator crest is less flaring distally. The "outer lip" (fig. 25) or ridge of the trochlea, which is beginning in *Notharctus*, is better developed in the New World monkeys and in all higher types, culminating in the anthropoids and man (fig. 28). Its presence marks the increase in width of the coronoid process of the ulna (fig. 33) which now supports the medial part of the circular radial head and takes up a part of the trochlea which was formerly (in Paleocene mammals) occupied by the medial part of the transversely oval head of the radius. This arrangement permits extreme supination and greatly strengthens the flexor side of the elbow joint.

The humerus of the macaque (fig. 28), a fairly central Old World monkey, is more or less intermediate between the lemuroid

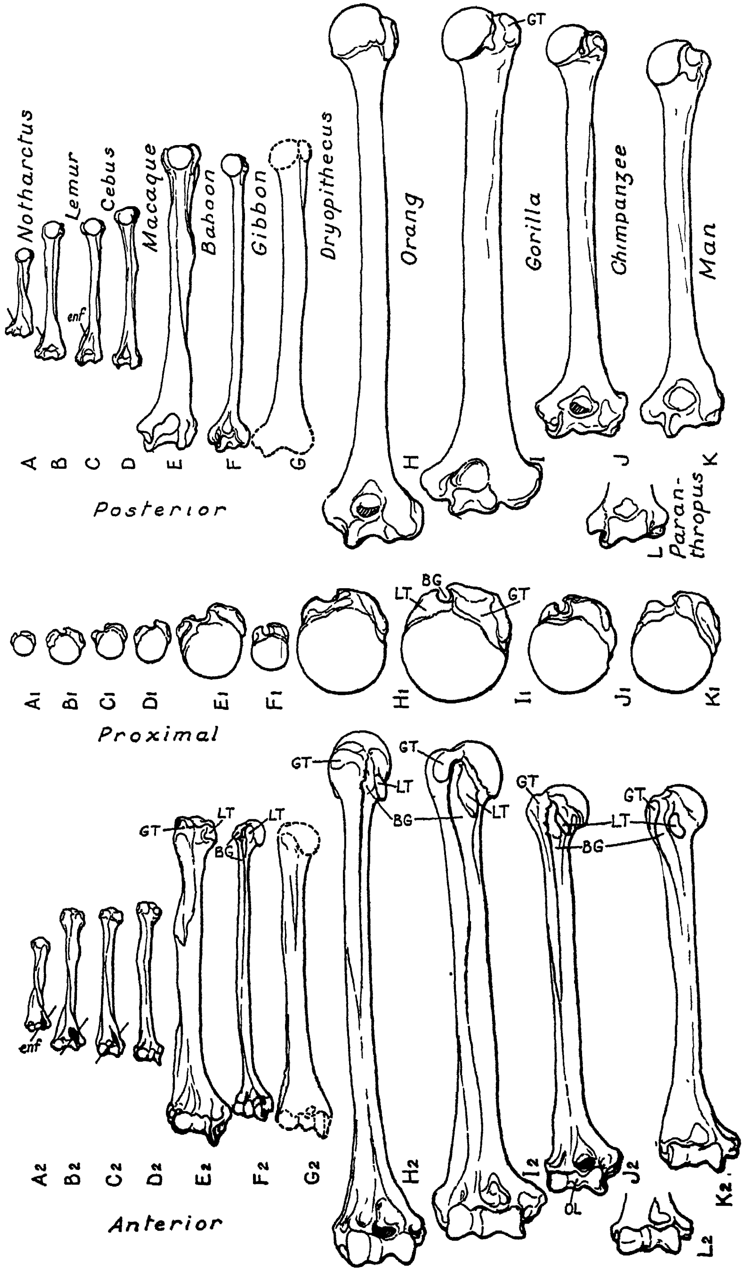


FIG. 28. Humeri of monkeys, anthropoid apes, and man. After Gregory.

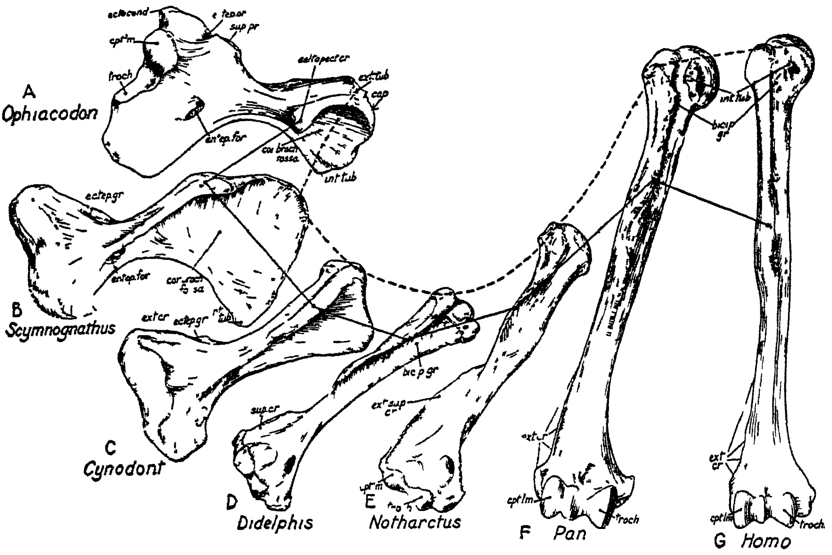


FIG. 29 Anterior aspect of the right humerus, in standing pose; structural series, from primitive mammal-like reptile to man. From Gregory. A after Romer and Price, B after Broili and Schroder; C–G from specimens.

and anthropoid types. The gibbons (fig. 28) with their extremely long arms and fully brachiating habits are often regarded as irrevocably specialized side lines (Howell and Straus, 1931). But this conclusion takes for granted the dogma of irreversibility and disregards the principle of correlated changes in structure and function. The humerus of the orang (fig. 28) looks almost as if it were a gigantic gibbon humerus. The fossil humerus referred to the Miocene *Dryopithecus* (fig. 28) combines features of the gibbon and of the modern great apes (Gregory, 1928; Ehrenberg, 1938).

The apes all have the ability to swing the arm around the shoulder joint, and describe a very low cone or almost a circle. The human arm has lost little if any of this ability, and the whole shoulder girdle and arm and hand of man (fig. 33) differ from those of the chimpanzee and gorilla only in the proportional emphasis of certain parts, as of the thumb in man or the great width of the hand in old male gorillas.

The distal end of a humerus (fig. 28) found by Broom at Kromdrai near the site of the *Paranthropus* type skull is confidently referred by Broom to that genus. In other features (e.g., jaws and teeth) the Australopithecinae present a mixture of ape-like and human features, and it is not surprising to find more or less mixed or generalized features in the humerus. But even if we set this specimen aside for the present, the humeri (fig. 28) of chimpanzees and gorillas differ from those of man chiefly in rather small proportional measurements.

RETROSPECT

Man has inherited from the earliest vertebrates, exemplified by the Silurian ostracoderms (fig. 1), the basic pattern of locomotion based upon bilaterally arranged myomeres on either side of an elastic axis and directed by a nervous system of primitive fish type. Man also owes to the ostracoderm grade the outgrowth of pectoral buds from the lateral myomeres and the beginnings of a pectoral girdle. To the same or some related group of pre-fishes, man owes the elaboration of bony tissue with its high adaptability in growth and plasticity in evolution.

Man owes to the crossopterygians (fig. 9) of early Devonian age, the modelling of the proximal metapterygial piece into a potential humerus, and of the second metapterygial piece into a potential ulna. The radius appears to be represented by the first pre-axial radial rod.

The many-jointed pectoral paddle of *Eusthenopteron* (fig. 6) and *Sauripterus* (fig. 31) was evidently quite flexible, the flexibility increasing towards the periphery. When such a fish paddle was transformed into a primitive tetrapod limb the widening of the head of the humerus (fig. 11) limited its mobility to a rocking and twisting movement of the shoulder, within the limits imposed by a rather narrow and warped articular surface and doubtless also by the capsular and associated ligaments. Especially in tetrapods further restraining and strengthening reactions were exerted by the acromial and coracoid processes (figs. 21, 23, 24, 26, and 32) and their ligaments surrounding the head of the humerus. The clavicle, on the one hand, transmitted to the sternum medially directed thrusts of the humerus, and, on the other hand, by being tied to the sternum medially and to the acromion laterally, the clavicle helped to prevent the humerus from being pulled too far away from the sternum. At the other extreme, in some specialized cursorial mammals (fig. 31, horse) the loss of the clavicles is compensated, and part of the weight of

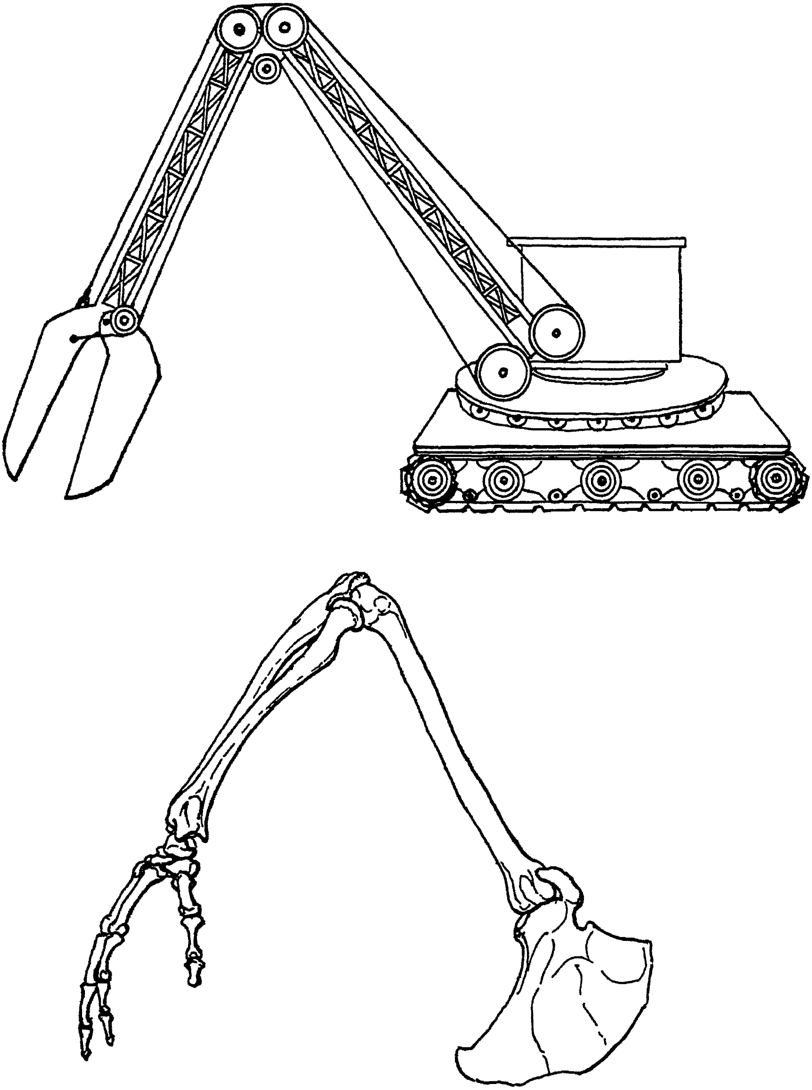


FIG. 30. The human arm and hand, conceived as a modified derrick and manual organ.

the thorax is supported, by the dorso-scapular ligament (Schmaltz, 1905) which permits a wide fore-and-aft swing of the scapula and humerus and lessens the danger of dislocation of the shoulder.

To the earliest tetrapod stage (figs. 9, 13), typified by the Upper Devonian, Carboniferous, and Permian labyrinthodonts, we owe the third major stage in the evolution of the pectoral girdle and limbs. At that time the bend at the elbow was sharply emphasized (fig. 13). Both ends of the humerus were wide (fig. 11), the very short shaft was strongly twisted (fig. 12), the entocondyle and ectocondyle, the extensor-supinator and deltopectoral crests were very prominent, while the articular surface at the head of the humeri formed a long, warped trackway (fig. 11). These features were profoundly modified or sacrificed in later stages, but they were nevertheless prerequisite for further advance. For our ancestors had to swim before they could crawl, to crawl before they could run, to run on the ground before they could climb and leap among the trees, to brachiate, at least to some extent, before they could walk upright on the ground.

To recapitulate, in general, primitive tetrapod humeri in both amphibians and reptiles were short and wide, with very wide distal ends for powerful flexors and extensors of the elbow. The large capitellum for the radius was chiefly ventral rather than distal in position, the elbows being sharply bent. The "head" or proximal articular facet was narrow, not spherical, and directed upward and inward rather than upward and backward. In modern urodele amphibians the proximal and distal ends of the humerus often become cartilaginous. Among later quadrupedal reptiles, the bent-limbed type of humerus was retained in lizards and *Sphenodon;* but the head (caput humeri) has thickened, and in the tortoise it became spherical.

When the length of the stride increases, as in crocodilians, the humeral shaft becomes longer and narrower, the entocondylar and ectocondylar processes disappear, and the elbow joint becomes more hinge-like. In side view such humeri are somewhat sigmoid. In the smaller pterosaurs, the shaft of the humerus was slender, but the deltopectoral crest remained large. In the largest pterosaurs, the humerus (fig. 31) is relatively short in comparison with the very long wing, supported by the enlarged fourth digit. By somewhat parallel changes the primitive thecodont humerus gave rise to the slender and light but strongly built bird humerus (fig. 31). At the opposite extreme in the aquatic icthyosaurs the humerus retained the wide distal end but was flattened to support the paddle-like forearm and hand.

In the line leading towards the mammals (fig. 31), the head be-

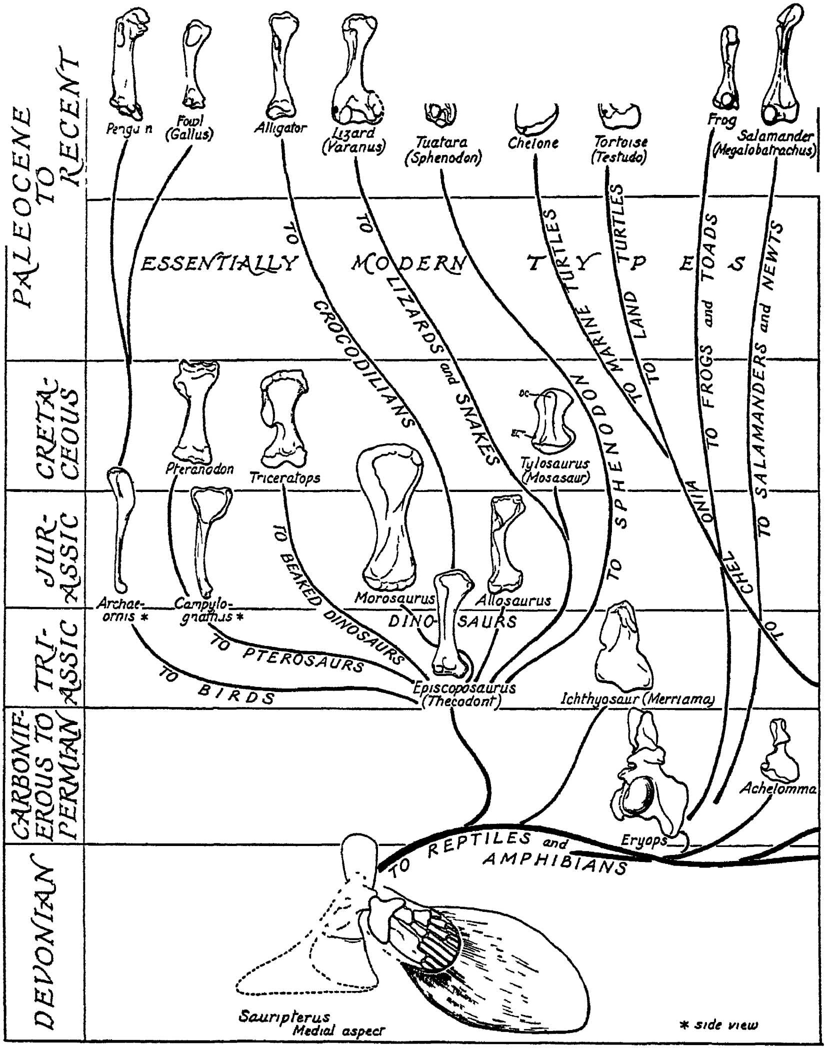
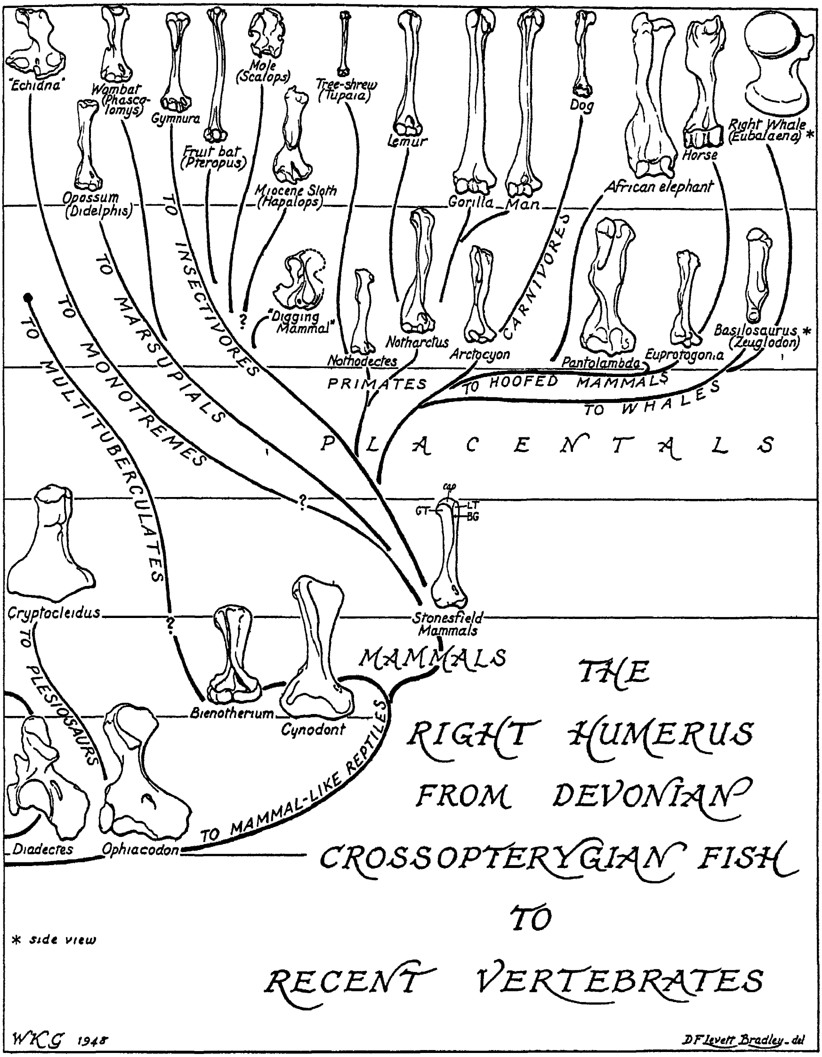


FIG. 31 (THIS PAGE AND OPPOSITE). Adaptive and phylogenetic evolution of the humerus in vertebrates.

came more spherical and directed backward, and the greater tuberosity developed on top of the deltoid crest. As the head withdraws dorsoposteriorly the deltopectoral crest, its greater tuberosity, and the lesser or medial tuberosity tended to define a



bicipital groove. In digging forms the humerus became secondarily widened and shortened, with extreme emphasis of the entocondylar and ectocondylar processes. Advanced aquatic specialization resulted in convergence towards the marine reptiles (fig. 31). At the other extreme, in the fruit bat, the shaft became very long and cylindrical. Among fast-running ungulates (fig. 31) the

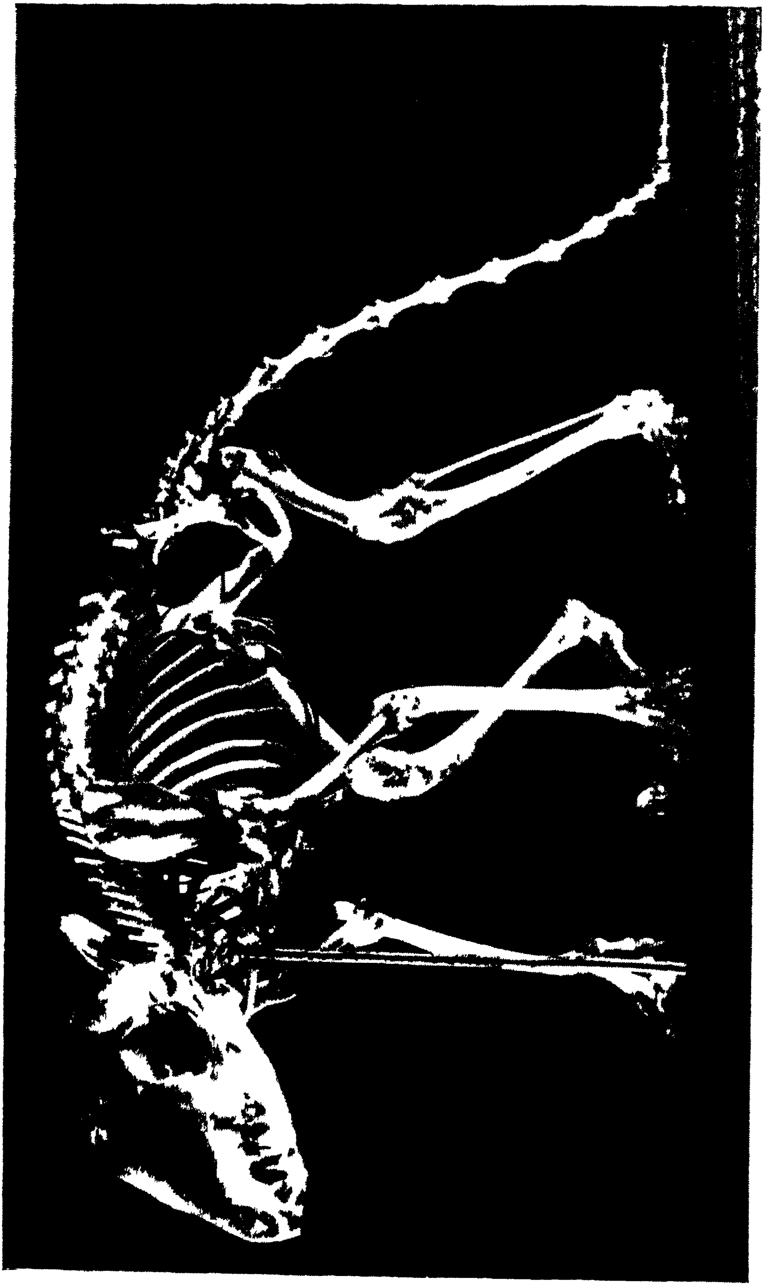


FIG. 32. Mounted skeleton of tree shrew, *Tupaia* sp.

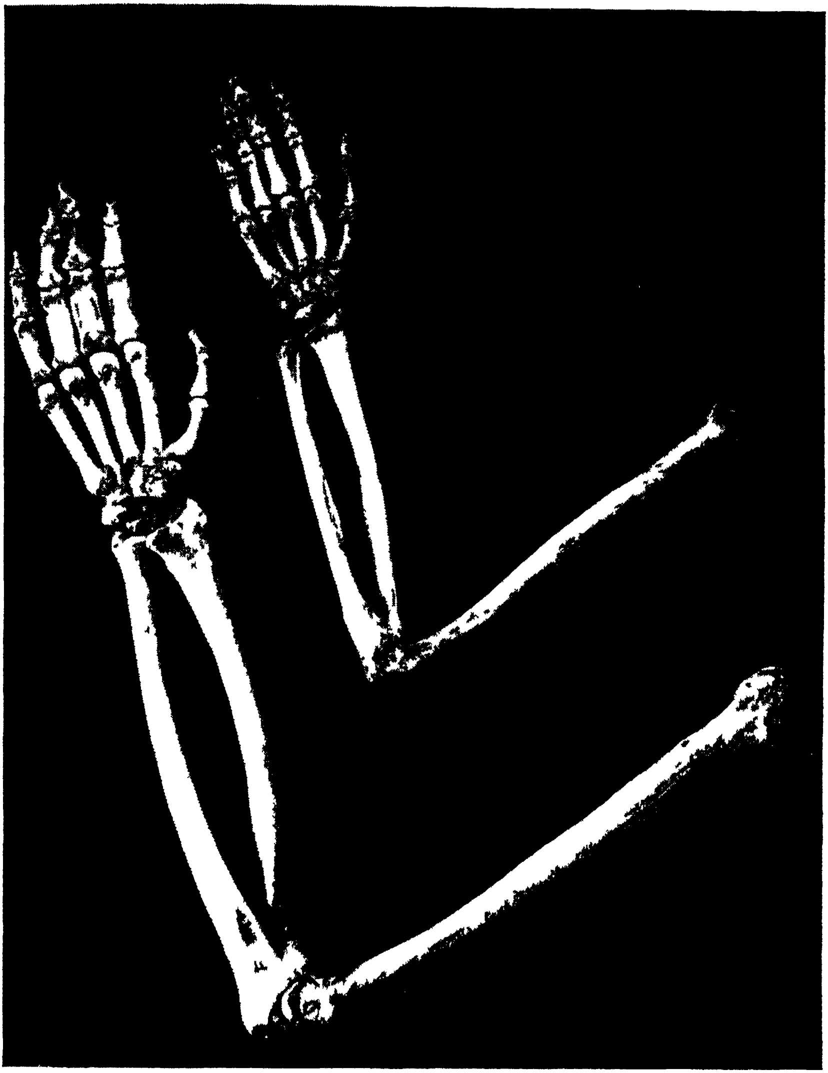


FIG 33 Right pectoral limb skeleton of man and gorilla Medial view of humerus and forearm, palmar view of wrist and hand

humerus is shortened and thickened, the elbow sharply bent and restricted to hinge-like movement.

The foregoing brief review has bearing on several classic problems that are still of daily importance to the student of evolution. The humerus in life is of course an indispensable part of a continuous, organized whole. In the dried skeleton it appears to be distinct from its neighbors because we do not usually see the joints and ligaments which connect it with its fellows and set limits to its movements, nor the opposing sets of the muscles which operate it, nor the endlessly complex nervous organization which moves and checks it purposively and requires of it sufficient quickness, precision, and power as a condition of its owner's survival.

In man as in other mammals the entire pectoral girdle and appendages serve as a system of compound extensible levers used in locomotion (fig. 24) and, by change of function, as an organ of prehension (fig. 21, 26, 30). As an organ of prehension and manipulation man's pectoral limbs (fig. 30) comprise on either side a modified derrick-crane with a movable base (the shoulder girdle), and a boom, the humerus. The latter supports at the elbow joint a secondary boom, the ulna and radius. This segment can be extended, flexed, and rotated. The wrist and hand (fig. 33) together form a third segment with a compound base (the wrist), and five jointed booms, the metacarpals and digits. Individually these act like little derricks, but collectively they serve as an organ for grasping, pulling, picking, hitting, batting, punching, twisting, throwing, drumming, piano-playing, violin playing, drawing, writing, gesturing, or what you will. In every one of these the humerus plays its part like a well-trained member of an orchestra.

The so-called mystery of adaptation, in the humerus as elsewhere, appears to be due partly to the very human habit of looking at only one finished product and imagining that it was "designed" first and made afterward. But the present sketch suggests (fig. 28) that the human humerus has evolved out of a primitive ape humerus, and the ape humerus from a macaque-like humerus, that in turn from a lemuroid stage, and so on back to *Eusthenopteron* and beyond that. Each earlier stage was attained by change of emphasis or proportion of certain still earlier parts and by correlated loss or increase in dimension of other earlier parts; also each and every earlier stage was prerequisite to all its derivatives. Such a system is operated according to geneticists by the testing of relative survival value in humeri of varying characteristics. The chance encounter of a given humerus type with fortuitously developed new opportunities has made possible every "creative," "emergent" type that happened to do well both in its older set-up and in the newer niche. Thus according to the "palimpsest" theory some "habitus" features of older stages are always modified or lost as new habitus features come in. In the evolution of the humerus from fish to man, *anisomerism* or changing emphasis of parts has played the leading part and *polyisomerism* is seen only in the tendency to develop separate centers of ossification for the epiphysis and tuberosities.

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REVIEW OF NEARCTIC *MYDAEA*, *SENSU STRICTO*, AND *XENOMYDAEA* (DIPTERA, MUSCIDAE)

BY FRED M. SNYDER

Several years ago a study of the Mydaeini of the world was undertaken. The present paper is a review of the Nearctic species. It covers the Nearctic species of *Mydaea* Robineau-Desvoidy, *sensu stricto*, and *Xenomydaea* Malloch. As the study progresses, it may be necessary either to broaden the limits of the genera involved or to restrict them considerably and propose names for various well-defined categories.

The Holarctic Mydaeini can, as a rule, be divided into five fairly distinct categories, although when African and Australian species particularly are studied forms are found which connect and invalidate most of the known generic characters.

For the present the genera will be treated in the traditional sense, which is essentially that of J. R. Malloch. The five groups mentioned above may be separated by the following key.

GENERA OF NEARCTIC MYDAEINI

1. With setulae on both dorsal and ventral surface of juncture of second and third wing veins (node) but not beyond..........................2
Without hairs on both surfaces of the node..........................3
2. Either front or oral margin or both protuberant in profile...*Xenomydaea* Malloch
Neither front nor oral margin protuberant in profile..........................*Mydaea* Robineau-Desvoidy, *sensu stricto*
3. Head of male distinctly flattened above; pra absent; arista long plumose; ovipositer usually with spines on suranal plate; small species.......................................*Hebecnema* Schnabl
Head of male not distinctly flattened above, pra present or absent; arista pubescent to plumose; ovipositer without thorns on suranal plate; larger species..........................4

4. With hairs or setulae on all of the following surfaces: notopleura adjacent to bristles, ventral surface of scutellum, hypopleura below spiracle.... ....*Helina* (*lucorum* group)[1]
Without hairs on all these surfaces....*Helina* Robineau-Desvoidy, *sensu lato*

It is with the greatest pleasure that I express my gratitude to the many museums and entomologists who have either lent material or allowed me to examine their material.

In particular, I wish to thank the authorities of the American Museum of Natural History who have made the entire collection of these flies available and allowed me to work them over. The United States National Museum has lent numerous specimens and permitted me to study their entire collection. Mr. J. R. Malloch offered several kind suggestions in the early stages of this study. Dr. H. C. Huckett was most kind in lending several European species unknown to me for comparison. To Dr. C. H. Curran I am particularly indebted for his kindness and many helpful suggestions.

Unless otherwise noted, all holotypes are or will be deposited in the American Museum of Natural History.

To conserve space, distribution records are limited to notation of the state, and the source of these specimens is omitted.

GENUS **MYDAEA** ROBINEAU-DESVOIDY

? *Fellaea* ROBINEAU-DESVOIDY, 1830, Mem. Acad. Roy. Sci. France, ser. 2, vol. 2, p. 476.

Mydaea ROBINEAU-DESVOIDY, 1830, Mem. Acad. Roy. Sci. France, ser. 2, vol. 2, p. 479.

Opsolasia COQUILLETT, 1910, Proc. U. S. Natl. Mus., vol. 37, p. 580.

In 1830, Desvoidy proposed the genus *Fellaea* for five new species without designating a genotype. Macquart (1835, p. 33) and Schiner (1864, p. 564) were of the opinion that the first species, *F. fera*, was the same as *Anthomyia urbana* Meigen. Apparently following this synonomy, Coquillett (1901, p. 137) designated *fera urbana* as genotype and placed *Fellaea* as a synonym of *Mydaea*.

However, Bezzi and Stein (1907, p. 615) placed *Fellaea* as a questionable synonym of *Phaonia* with *fera* as possibly the same as *Anthomyza basalis* Zetterstedt. Coquillett (1910, p. 545) in his second work on genotypes appears to have accepted

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[1] *Spilaria* authors, not Schnabl.

Bezzi and Stein's suggestion, since *Fellaea* is placed as a synonym of *Phaonia* in that paper.

If it should be shown that *fera* belongs to *Mydaea*, then the name *Fellaea* should replace *Mydaea*.

In 1910, Coquillett proposed the name *Opsolasia*, with *Lasiops clavicrura* Coquillett as genotype, for the group of species considered by authors to represent *Lasiops* Meigen. The validity of this need not concern us here, since *L. clavicrura* (= *orichalcea* Zetterstedt) is a *Mydaea* and hence *Opsolasia* becomes a synonym of *Mydaea*.

The genotype is *Musca pagana* Fabricius.

Besides the characters mentioned in the key, most species possess hairs on the notopleura adjacent to base of at least the posterior notopleural bristle and have thorn-like bristles on the suranal plate of the ovipositer.

KEY TO NEARCTIC *Mydaea* ROBINEAU-DESVOIDY, SENSU STRICTO

1. Dorsocentrals 2:4 2
   Dorsocentrals 2:3 .... *occimons*, new species
2. Scutellum yellow, contrasting sharply with the dark thoracic disc 3
   Scutellum dark, concolorous with the rest of the thorax 6
3. Palpi and antennae fulvous, at most only apex of third antennal segment infuscated 4
   Palpi and antennae entirely darkened 5
4. Lateral ventral margins of scutellum with some black bristles .... *flavicornis* Coquillett
   Lateral ventral margins of scutellum bare .... *impedita* Stein
5. *Males:* acrosticals 0:2; hind femora with a complete row of anteroventral bristles and with a row of posteroventral bristles on basal one-half to three-fourths. *Females:* humeri concolorous with disc; fore tibiae without median posterior bristles .... *pagana* (Fabricius)
   Males: acrosticals 0 : 1; hind femora with anteroventral bristles only on basal half and with at most one or two posteroventral bristles at base. *Females:* humeri fulvous, contrasting with darker disc; fore tibiae with one or two median posterior bristles .... *occidentalis* Malloch
6. Eyes distinctly haired; wing base of males infuscated; of females deep yellow to fulvous .... *orichalcea* (Zetterstedt)
   Eyes bare; wing bases not infuscated or deep yellow to fulvous 7
7. Fore and mid tibiae with a submedian ventral bristle ..... *armatipes* Malloch
   Fore and mid tibiae without submedian ventral bristles 8
8. Knobs or more of halteres darkened 9
   Knobs of halteres not darkened 11
9. Subtriangular portion of hypopleura above hind coxae with one or more setulae; longest aristal hairs distinctly longer than greatest diameter of arista .... *nubila* Stein
   Subtriangular portion of hypopleura above hind coxae bare; longest aristal hairs not longer than greatest diameter of arista 10

10. Palpi of the male abruptly dilated on apical three-fourths; mid femora with only one apical bristle anteriorly .... *palpalis* Stein[1]

Palpi of the male not abruptly dilated on apical three-fourths; mid femora with an apical anterior and anterodorsal bristle........ *hannai* Malloch[1]

11. Subtriangular portion of hypopleura above hind coxae without hairs or setulae; the aristal hairs usually shorter than greatest width of third antennal segment..12

Subtriangular portion of hypopleura above hind coxae with one or more hairs or setulae, but, if bare, then the aristal hairs are as long as, or longer than, greatest width of third antennal segment..............17

12. Males...13

Females...14

13. Second antennal segment concolorous with third; fore and mid femora darkened. .... *brevipilosa* Malloch[2]

Second antennal segment lighter colored than third; fore and mid femora fulvous... .... *persimilis* Malloch[2]

14. All femora mostly darkened, often the base or more of at least the hind tibiae darkened; longest aristal hairs as long as, or distinctly longer than, width of third antennal segment.................................15

All femora yellow to orange; at most only the fore femora partly darkened; longest aristal hairs not more than half as long as width of third antennal segment...16

15. Tibiae black or dark reddish brown.................. *obscurella* Malloch

Tibiae yellow to pale orange...................... *neobscura*, new species

16. Second antennal segment brownish orange; longest hairs on arista two times as long as its greatest diameter.................. *brevipilosa* Malloch

Second antennal segment entirely yellow; longest hairs on arista not longer than its greatest diameter....................... *persimilis* Malloch

17. Pra distinctly longer than posterior notopleural bristle and almost or quite as long as the first postsutural dorsocentral bristle...... *urbana* (Meigen)

Pra at most only as long as posterior notopleural bristle and not nearly so long as the first postsutural dorsocentral bristle..................18

18. Males...19

Females...27

19. Sternopleurals 1 : 2 or, if a weak lower anterior setula is present, then the calyptrae are whitish or hyaline.................................21

Sternopleurals 2 : 2, the lower anterior one strong; calyptrae yellow.......20

20. All femora infuscated.............................. *electa* (Zetterstedt)

At most only the fore and base of mid femora infuscated.... *neglecta* Malloch

21. Front at narrowest part not nearly so wide as diameter of the anterior ocellus; small, slightly shiny species; hind femora with a complete row of posteroventral bristles.......................... *narona*, new species

Front at narrowest part distinctly wider than anterior ocellus; larger species, or, if small, then without a complete row of posteroventral bristles on hind femora...22

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[1] I have been unable to find reliable characters to separate the females of these two species.

[2] It is possible one of these two species is the European *deserta* Zetterstedt which I have not seen. Of the two, *brevipilosa* agrees best with existing descriptions.

22. Thorax with four clearly visible vittae; with dense grayish to yellowish gray pruinescence.......................................23

Thorax not vittate or with only two very narrow and scarcely visible presutural vittae.......................................25

23. Apical fore tarsal segment slightly but distinctly widened; without a weak lower anterior sternopleural setula...............*discimana* Malloch

Apical fore tarsal segment not at all widened; often with a short, weak, lower anterior sternopleural setula.......................................24

24. All femora partly or entirely infuscated; calyptrae white.......................................*neobscura*, new species

All femora mostly or entirely yellow; calyptrae distinctly yellow.......................................*neglecta* Malloch

25. Fore and mid tibiae fulvous.........................*winnemana* Malloch

Fore and mid tibiae black.......................................26

26. Longest aristal hairs as long as, or longer than, width of third antennal segment; abdomen without dorsal or lateral checkerings; mid femora with an apical anterior and anterodorsal bristle; halteres very deep orange to brownish black............................*nubila* Stein

Longest aristal hairs not more than three-fourths as long as width of third antennal segment; abdomen with dorsal and lateral checkerings; mid femora with only the apical anterodorsal bristles; halteres light yellow to pale fulvous.............................*obscurella* Malloch

27. Fifth fore tarsal segment distinctly broader than others...................28

Fifth fore tarsal segment not broader than the others..................29

28. Fore femora fulvous; fore tibiae with at least one and usually two median posterior bristles; thoracic and abdominal pruinescence yellowish gray to golden.................................*discimana* Malloch

Fore femora infuscated; fore tibiae without median posterior bristles; thoracic and abdominal pruinescence bluish gray.......................................*discimanoides*, new species

29. Sternopleurals 2 : 2, the lower anterior one strong, if 1 : 2 then the femora entirely fulvous...............................*neglecta* Malloch[1]

Sternopleurals 1 : 2, if with a weak lower anterior one, one or more femora largely or entirely infuscated.................................30

30. All tibiae and extreme apices of femora yellow; hind femora usually with distinct posteroventral bristles on basal half......................31

All tibiae and entire femora darkened, at most the hind tibiae reddish brown in the middle; hind femora with posteroventral setulae confined to basal fourth to basal fifth..................................33

31. Hind femora with distinct posteroventral bristles on basal third or more; calyptrae distinctly yellowish to fulvous..........*narona*, new species

Hind femora without posteroventral bristles, at most with two or three weak posteroventral setulae; calyptrae white or very pale yellow.........32

32. Third antennal segment 2.8 to 3.0 times as long as second; without a weak lower anterior sternopleural setula...............*winnemana* Malloch

Third antennal segment at most 2.5 times as long as second; usually with a very weak but distinct lower anterior sternopleural setula. . . . . *neobscura*, new species

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[1] I have seen no female specimens of *electa*, but it is probable that they may be separated from *neglecta* by having the femora infuscated in part.

33. Thorax shiny, non-vittate; abdomen without checkerings. . . . . *nubila* Stein

Thorax densely grayish pruinescent, quadrivittate; abdomen with dorsal and lateral checkerings. . . . . *obscurella* Malloch

Mydaea occimons, new species

MALE: Length 6 mm. Head black, grayish pruinescent, frontal vitta velvety black. Narrowest part of front two-thirds as wide as distance across posterior ocelli inclusive. Parafrontals subcontiguous, with seven or eight pairs of bristles which extend to anterior apex of ocellar triangle, the anterior four or five pairs of bristles strongest. Juncture of parafacials and parafrontals as long as width of third antennal segment, only slightly narrower below. Cheeks twice as high as width of third antennal segment, with numerous bristly hairs along lower margin, the hairs extending onto facial region to a level slightly below lower level of eyes. Longest aristal hairs as long as, or very slightly longer than, greatest aristal diameter. Eyes bare or with very short, sparse hairs.

Thorax black, slightly brownish gray pruinescent, quadrivittate. Presutural acrostical setulae in five to seven irregular rows and a pair of prescutellar acrostical bristles. Dorsocentrals 2:3; pra almost or quite as long as the rather short posterior notopleural bristle and half as long as the first postsutural dorsocentral; notopleura without hairs at base of posterior notopleural bristle. Sternopleurals 1:2. Hypopleura and sternites bare.

Legs black. Fore femora normal. Fore tibiae bare in the middle. Mid femora with five ventral bristles on basal half and a row of scarcely developed anterior ones on basal half, with the apical anterior bristles scarcely developed. Mid tibiae with two median posterior bristles. Hind femora with a row of anteroventral bristles on apical two-thirds and four or five short but distinct posteroventral bristles on basal half, the clothing setulae on the ventral surface slightly longer and more well developed than usual. Hind tibiae with two median anterodorsal and anteroventral bristles.

Wings brownish yellow at base, becoming hyaline beyond juncture of second and third wing veins, veins narrowly bordered with infuscation. Costal thorn and setulae scarcely developed; with bristles above and below a juncture of second and third wing veins. Other vein bare. Third and fourth veins divergent apically. Calyptrae with distinct, broadly yellowish margins, the central portion whitish hyaline. Halteres deep yellow to brown.

Abdomen colored as in *nubila* Stein. Basal sternite bare. Fifth only moderately cleft, without distinctive armature.

FEMALE: Length 6.5 mm. Similar to the male, differing from it in having the front at vertex five-fourteenths of head width, slightly widened anteriorly. With a complete row of stronger parafrontal bristles and numerous setulae laterad to them. The parafrontals more brownish pruinescent, and the parafrontal setulae do not extend quite so far dorsally onto the facial ridges, reaching a level slightly above apex of third antennal segment. The pra is almost as long as the first postsutural dorsocentral bristle. The costal thorns are more well developed, and the wing bases are a lighter yellow. The clothing setulae on the ventral surface of hind femora are undeveloped.

TYPE MATERIAL: Holotype, male, Red River, New Mexico, August 14, 1940, 9000 feet (F. M. Snyder); allotype, female, Valdez, Alaska, June 8, 1921 (J. M. Aldrich); in the United States National Museum.

Before the male was collected, the female had been sent to Herr O. Ringdahl who wrote that it was not conspecific with the closely related *soot-reynei* Ringdahl (1928, p. 45). *Occimons* seems to be most closely related to that northern European species. The male differs from a European specimen of *soot-reynei*, which was determined by Ringdahl and kindly lent by Dr. H. C. Huckett, in having a narrower front, higher cheeks, hairs extending farther upward onto the facial ridges, and the aristal hairs longer. In *soot-reynei*, the latter are not over half as long as greatest aristal diameter, and the fore tibiae have a short median posterior bristle. The fifth sternite of *occimons* does not have such long processes nor such well-developed apical bristles as does *soot-reynei*.

Mydaea impedita Stein

Mydaea impediia STEIN, 1920, Arch. Naturgesch., sect. A, vol. 84, p. 33.
Mydaea flavidipalpis MALLOCH, 1923, Canadian Ent., vol. 55, p. 221.

MALE: Length 7 mm. Head black, silvery gray pruinescent. Front at narrowest part about twice as wide as anterior ocellus. Parafrontals contiguous, at narrowest part each about as wide as anterior ocellus, with four or five pairs of bristles and one or two setulae, none of which extends beyond apical third of front. Juncture of parafacials and parafrontals about twice as long as greatest diameter of arista, parafacials somewhat narrower below. Cheeks as high as width of third antennal segment. Antennae and palpi entirely yellow. Third antennal segment two and one-fourth times as long as second. Longest aristal hairs about as long as narrowest width of third antennal segment.

Thorax largely darkened, humeri, postalar declivities, and scutellum yellow in ground color, rest black, grayish pruinescent, narrowly quadrivittate. Bristled as in *pagana* (Fabricius) but with only one pair of prescutellar acrostical bristles and with a few scutellar setulae which descend below basal marginal bristle but do not invade the ventral surface.

Legs entirely yellow. Fore femora normal. Fore tibiae bare in the middle. Mid femora with two or three ventral bristles on basal half, and with only one apical anterodorsal bristle. Mid tibiae with three or four median posterior bristles. Hind femora with four or five strong apical anteroventral bristles and with a row of much shorter ones which extend to the base, none of the latter more than half as long as diameter of the femora where situated. Hind tibiae with two anterodorsal, and three or four anteroventral, median bristles.

Wings yellowish hyaline, especially at base. Costal thorns and setulae undeveloped. Third and fourth veins subparallel at apices.

Abdomen black, grayish yellow pruinescent, with an indistinct dorsocentral vitta and with dorsal and lateral checkerings. Basal sternite bare; fifth distinctly cleft, with a row of four or five moderately well-developed bristles on disc of processes. Hypopygium and apex of fifth sternite yellow to orange.

FEMALE: Length 7 to 8 mm. Similar to the male, differing from it in having the front at vertex one-fourth of head width, only slightly widened anteriorly. Fore tibiae with a median posterior bristle. Mid femora with the basal anterior bristles moderately well developed. Abdomen with slight dorsal and lateral checkerings.

SPECIMENS EXAMINED: One male, Woods Hole, Massachusetts, 7-00, holotype (Zoological Museum, University of Berlin), and seven males and five females from Massachusetts, New York, New Jersey, Pennsylvania, Maryland, North Carolina, and Virginia.

Mydaea flavicornis Coquillett

Mydaea flavicornis Coquillett, 1902, Proc. U. S. Natl. Mus., vol. 25, p. 122; Stein, 1920, Arch. Naturgesch., sect. A, vol. 84, p. 26; Malloch, 1921, Canadian Ent., vol. 51, p. 10; 1923, *ibid.*, vol. 55, p. 220.

Male: Length 5 mm. Very similar to *impedita* Stein, differing from it in having the humeri entirely darkened. The scutellum with a row of distinct setulae along the ventral margin on the basal half.

Mid tibiae with only two median posterior bristles. Hind tibiae with two anterodorsal and two or three anteroventral bristles.

Abdomen with distinct dorsocentral vitta, and the fifth sternite with only two or three bristles on the disc of the processes.

Female: Length 6 to 7 mm. Similar to the male, differing from it in having the front one-fourth of head width at vertex and of almost uniform width throughout. The humeri distinctly yellowish as in *impedita* Stein.

Specimens Examined: Five males and four females from Missouri, Wisconsin, Indiana, Pennsylvania, New York, and the holotype male in the United States National Museum from Quebec.

Mydaea pagana (Fabricius)

Musca pagana Fabricius, 1794, Entomologia systematica, vol. 4, p. 326; 1805, Systema antliatorum, p. 288; Fallén, 1825, Muscides, p. 79.

Anthomyia pagana Meigen, 1826, Systematische Beschreibung der bekannten Europäischen zweiflugeligen Insekten, vol. 5, p. 116.

Mydaea scutellaris Robineau-Desvoidy, 1830, Mem. Acad. Roy. Sci. France, ser. 2, vol. 2, p. 480.

Spilogaster lucana Rondani, 1870, Bull. Soc. Ent. Italiana, vol. 2, p. 323.

Aricia pagana Pandellé, 1899, Rev. Ent. France, vol. 18, p. 86.

Mydaea pagana Meade, 1897, Descriptive list of the British Anthomyidae, vol. 1, p. 16, Stein, 1914, Arch. Naturgesch., sect. A, vol. 79, p. 21; 1916, *ibid.*, sect. A, vol. 81, p. 66; Séguy, 1923, Faune de France (Anthomyidae), p. 255; Karl, 1928, Die Tierwelt Deutschlands, pt. 13, Diptera, vol. 3, p. 75.

Male: Length 8 mm. Head black, golden yellow pruinescent. Front at narrowest part not so wide as diameter of anterior ocellus. Parafrontals contiguous on almost half their length and with a row of seven or eight bristles which do not extend beyond the point where the parafrontals become contiguous, but the small accessory setulae extend almost to the ocellar triangle.

Juncture of parafacials and parafrontals twice as long as greatest diameter of arista; parafacials not narrowed below. Cheeks one and one-half times as high as width of third antennal segment. Eyes bare or with short, sparse hairs, the facets somewhat larger on the upper surface of the eye. Antennae and palpi black. Third antennal segment two and one-fourth times as long as second. Longest aristal hairs almost or quite as long as width of third antennal segment.

Thorax black, with dense grayish pruinescence, distinctly quadrivittate. Scutellum yellow, contrasting sharply with the rest of the thorax. Presutural acrostical setulae in about 12 irregular rows and with two pairs of long, strong, prescutellar, acrostical bristles; dorsocentrals 2:4; intra-alars 2; pra as long as, or slightly longer than, the posterior notopleural bristle, the latter with distinct setulae adjacent to its base. Scutellar setulae descending slightly below level of marginals. Sternopleurals 1:2; hypopleura and sternites bare.

Legs, except coxae, trochanters, and tarsi yellow. Fore femora normal. Fore tibiae bare in the middle. Mid femora with a row of 10 to 12 very long ventral bristles. Mid tibiae with three to five median posterior bristles. Hind femora with a complete row of long anteroventral bristles and with an almost complete row of shorter posteroventral bristles. Hind tibiae with two or three median anterodorsal and anteroventral bristles.

Wings yellowish hyaline, especially at the base. Third and fourth veins divergent at apices. Costal setulae and thorns scarcely developed. Calyptrae and halteres yellowish.

Abdomen black, with dense yellowish pruinescence, indistinct dorsal and lateral checkerings and with a narrow dorsocentral vitta. Basal sternite bare; apices of other sternites with one or two pairs of apical bristles; fifth distinctly cleft, without distinct long bristles.

FEMALES: Length 7.5 mm. Similar to the male, differing from it in having the front at vertex one-third of head width, widened anteriorly. Thorax usually with only one pair of prescutellar acrostical bristles. Hind femora without as strong posteroventral bristles.

Description based on 13 males and three females from Finland, Sweden, the Netherlands, and Germany determined by Ringdahl, Karl, Tiensuu and De Meijere.

I have not seen any North American specimens that I considered to be conspecific with the foregoing European ones. *Pagana* has been recorded several times from North America, but in all cases such specimens in my opinion have been *occidentalis* Malloch or closely related species. It is always possible that *pagana* occurs in North America so it has been included, especially since it is the genotype.

Mydaea occidentalis Malloch

Mydaea occidentalis MALLOCH, 1920, Trans. Amer. Ent. Soc., vol. 44, p. 134; 1921, Canadian Ent., vol. 53, p. 9; 1923, *ibid.*, vol. 55, p. 220.

MALE: Length 6 to 7 mm. Very similar to *pagana* (Fabricius). Front at narrowest part not quite so wide as the distance across posterior ocelli inclusive. Parafrontals subcontiguous, about as wide as the diameter of anterior ocellus; with six to eight pairs of bristles and setulae which extend midway to the ocellar triangle. The small parafrontal setulae do not extend posteriorly beyond middle of front. Juncture of parafacials and parafrontals one-half as long as width of third antennal segment, parafacials slightly narrowed below. Antennae and palpi black. Third antennal segment twice as long as second. Longest aristal hairs as long as width of third antennal segment.

Thorax colored and bristled as in *pagana* except that the pra is not quite so long as posterior notopleural bristle; with a single pair of prescutellar acrostical bristles.

All femora and tibiae entirely yellow, bristled as in *pagana*, except the long anteroventral ones on hind femora are confined to apical half, and there are no well-developed posteroventral bristles except for an occasional one or two at base.

FEMALE: Length 7 mm. Similar to the male, differing from it in having the front at vertex a little over one-fourth of head width, widened anteriorly. Humeri distinctly yellowish. Fore tibiae with one or two median posterior bristles.

SPECIMENS EXAMINED: Seven males and six females from Maine, Massachusetts, New York, Michigan, Wisconsin, Minnesota, Quebec, and British Columbia.

There is a single female from the Zoological Museum of the University of Berlin from "U.S.A." bearing the label "*Mydaea humeralis-tincta* Zetterstedt" in Stein's handwriting before me. I believe this to be one of the two female specimens from the Hough collection mentioned by Stein (1897a, p. 38) when *humeralis* Zetterstedt was reported from North America. I have not seen determined European specimens of *humeralis* Zetterstedt and cannot, therefore, state definitely whether or not the above specimen is conspecific with the European *humeralis* Zetterstedt.

There is considerable confusion regarding the availability of the name *Anthomyza humeralis* Zetterstedt in *Mydaea*, and the following remarks are made not to settle any question but to present the problem.

In reporting on the Zetterstedt collection, Ringdahl states that he has not seen the type but is of the opinion that *Phaonia norvegica* Ringdahl is *humeralis* Zetterstedt. On the other hand, Bezzi and Stein (1907, p. 640) placed it in *Mydaea* as a good species.

Robineau-Desvoidy (1830, p. 481) described a *Mydaea humeralis* so the name *humeralis* Zetterstedt is not available in *Mydaea* unless Desvoidy and Zetterstedt had the same species. Bezzi and Stein were questionably of the opinion that *Mydaea humeralis* Robineau-Desvoidy was the same as *tincta* Zetterstedt. If this is true, then the name *humeralis* Robineau-Desvoidy must replace *tincta* Zetterstedt.

It may prove that we are dealing with a single species having two geographical forms, *tincta* Zetterstedt and *occidentalis* Malloch, in which case the name *occidentalis* would become a synonym of *tincta* (= ? *humeralis* Robineau-Desvoidy). If there are two distinct species, then the name *occidentalis* Malloch is the next available one for *humeralis* Zetterstedt *nec* Robineau-Desvoidy if Stein's manuscript synonomy should prove correct.

Occidentalis is very similar to the European *tincta* and is separated from it by very minor characters, namely, the broader front in the male. *Pagana* has the front at narrowest part not so wide as diameter of anterior ocellus, *tincta* has it slightly wider than the anterior ocellus, and *occidentalis* has it almost as wide as distance across posterior ocelli.

As pointed out by Malloch in his original description of *occidentalis*, *tincta* possesses four to five anterodorsal bristles on the hind tibiae, while *occidentalis* has two to three. The female of *occidentalis* also differs from *tincta* in having entirely fulvous femora, while the latter has at least the fore femora infuscated.

I have dissected the male genitalia of *occidentalis* and *tincta* and can find no reliable distinguishing characters. However, genitalic characters do not appear to be of great value in this genus for separating closely related species.

Mydaea orichalcea (Zetterstedt)

? *Aricia subfuscinervis* var. *B* Zetterstedt, 1845, Diptera Scandinaviae, vol. 4, p. 1489.

Aricia orichalcea Zetterstedt, 1849, Diptera Scandinaviae, vol. 8, p. 3285; Stein, 1902, Wiener Ent. Zeitg., vol. 21, p. 39.

Lasiops clavicrura Coquillett, 1900, Proc. Washington Acad. Sci., vol. 2, p. 444.

Opsolasia clavicrura Coquillett, 1910, Proc. U. S. Natl. Mus., vol. 37, p. 580.

Mydaea astuta Stein, 1920, Arch. Naturgesch., sect. A, vol. 84, p. 29.

Mydaea clavicrura Malloch, 1921, Canadian Ent., vol. 53, p. 7; 1923, *ibid.*, vol. 55, p. 220.

Mydaea orichalcea Stein, 1914, Arch. Naturgesch., sect. A, vol. 79, p. 20; 1916, *ibid.*, sect. A, vol. 81, p. 66; Ringdahl, 1924, Ent. Tidskr., vol. 45, p. 45.

Male: Length 8 mm. Head black, brownish gray pruinescent. Front at narrowest part slightly less than twice the diameter of anterior ocellus. Parafrontals not contiguous, separated by a distance equal to diameter of anterior ocellus; with a row of eight to 12 well-developed parafrontal bristles and four to five setulae basad of these which extend to a level opposite anterior ocellus. Juncture of parafacials and parafrontals as long as greatest width of third antennal segment; parafacials very slightly narrowed below. Cheeks two and one-half times as high as width of third antennal segment, lower margin with three or four rows of moderately well-developed, upwardly curved bristles. Eyes very distinctly haired. Antennae and palpi black. Third antennal segment one and one-half times as long as second. Arista pubescent, the longest hairs at most as long as greatest aristal diameter.

Thorax black, scarcely pruinescent, slightly shiny, indistinctly brownish quadrivittate. Presutural acrostical setulae in eight to 10 irregular rows more hair-like, longer and numerous than usual; with one pair of prescutellar acrostical bristles; dorsocentrals 2:4; intra-alars 2; with several notopleural setulae adjacent to base of posterior bristle; pra about one-half as long as bristle behind it. Scutellar setulae descending distinctly below level of margin of bristles but not invading the ventral surface. Sternopleurals 1:2; hypopleura usually with setulae above base of hind coxae.

Legs entirely black. Fore femora normal. Fore tibiae bare in the middle. Mid femora with the clothing setulae slightly longer and denser than usual, and with the usual row of bristles on basal half of the anterior surface shorter than usual; with six to eight well-developed ventral bristles on basal half and with several rows of closely placed, shorter, hair-like setulae. Mid tibiae with three to five median posterior bristles and often with a very short, median, anterodorsal bristle. Hind femora with a complete row of long, anteroventral and posteroventral bristles, those on the former surface more complete and slightly longer. Hind tibiae with three to five anterodorsal and usually three anteroventral bristles.

Wings smoky, very distinctly blackened at base. Costal setulae and thorns only slightly developed. Third and fourth veins slightly divergent. Posterior cross vein moderately curved. Halteres and calyptrae yellow to orange, contrasting quite sharply with the base of the wings.

Abdomen black, yellowish gray pruinescent, with a distinct pair of subtriangular black spots on second visible tergite and with a less distinct pair at apex of third; with indistinct dorsal and lateral checkerings. Basal sternite usually bare; fifth moderately cleft, without outstanding bristles.

FEMALE: Length 8 to 9 mm. Similar to the male, differing from it in having the front one-third of head width. Palpi slightly more broadened. Fore tibiae with two or three median posterior bristles. Mid tibiae usually with two or three stronger, submedian, anterodorsal bristles. Posteroventral bristles on hind femora confined to basal half. Thorax quite distinctly quadrivittate. Prescutellar acrostical setulae shorter than in male. Wings yellowish hyaline at base. Abdomen without subtriangular spots, but with dorsal and lateral checkerings.

SPECIMENS EXAMINED: One male, Popoff Islands, Alaska, type of *L. clavicrura* Coquillett, in United States National Museum; one female, Marshal Pass, Colorado, cotype of *M. astuta* Stein, in United States National Museum; four males and two females from Alaska and Colorado.

This species shows superficial resemblance to *Helina laxifrons* Zetterstedt in its dark color and very dark wing bases as well as hairs at the base of the posterior notopleural bristle. It differs from all species usually placed in *Mydaea, sensu stricto*, in having eyes very distinctly haired. If this character should be considered of generic value, the name *Opsolasia* Coquillett must be used.

Mydaea armatipes Malloch

Mydaea armata MALLOCH (*nec* Stein), 1920, Trans. Amer. Ent. Soc., vol. 46, p. 135.

Mydaea armatipes MALLOCH, 1921, Canadian Ent., vol. 53, p. 10; 1923, *ibid.*, vol. 55, p. 10.

MALE: Length 9 mm. Head black, grayish pruinescent. Front at narrowest part about twice as wide as diameter of anterior ocellus, with a complete row of bristles and setulae extending almost to the ocellar triangle. Juncture of parafacials and parafrontals distinctly longer than greatest width of third antennal segment, parafacials not distinctly narrowed below. Cheeks about as high as length of third antennal segment or one-third of eye height, with a row of weakly developed, upwardly curved bristles. Eyes bare. Second antennal segment brownish to orange, third black, one and one-half times as long as second. Palpi black, sometimes slightly brownish at base. Longest hairs on arista only very slightly longer than its greatest diameter.

Thorax black, yellowish gray pruinescent, distinctly quadrivittate. Bristled as in *urbana* Meigen.

Coxae, trochanters, tarsi, and basal portion or more of all femora infuscated. Tibiae and apical portion of femora yellowish. Fore femora normal. Fore tibiae with one or two fine, median, posterior bristles and a much more well-developed ventral bristle on apical third. Mid femora with a closely placed series of about 12 bristles on apical half. Hind femora with a complete row of well-developed anteroventral bristles. Hind tibiae with two or three median anterodorsal and anteroventral bristles.

Wings hyaline, yellowish orange at base. Third and fourth veins divergent at apices. Costal thorns and setulae not prominent. Calyptrae and halteres orange.

Abdomen black, yellowish pruinescent, with a narrow dorsocentral vitta and dorsal and lateral checkerings. Basal sternite hairy; fifth moderately cleft, disc of each process with three or four strong bristles. Hypopygium black.

FEMALE: Length 9 to 10 mm. Similar to the male, differing from it in having the front at vertex one-third of head width widened anteriorly. The parafacials and parafrontals more distinctly brownish pruinescent. Legs bristled as in the male, but not so extensively infuscated.

SPECIMENS EXAMINED: Two males and three females from

Oregon, Montana, Wyoming, Colorado, and New Mexico, including the holotype in Illinois Natural History Survey Collection.

In his original description, Malloch states that he cannot ascertain from his specimens whether or not the armature of the ovipositer bears thorns as in *urbana* and related species. In a specimen from Aspen, Colorado, it is possible to see a small portion of the ovipositer, and there are several thorns present on suranal plate.

This species should be readily distinguishable from any of the other known Nearctic *Mydaea* by the presence of the ventral bristles on the mid and hind tibiae as well as the pubescent arista.

This species might be placed in the genus *Xenomydaea* because of the slightly protuberant front, but the oral margin is not so protruding as in the genotype.

Mydaea hannai (Malloch)

Helina hannai Malloch, 1921, Canadian Ent., vol. 53, p. 109; 1923, North American Fauna, no. 46, p. 189.

Male: Length 7 mm. Head black, whitish gray pruinescent. Front at narrowest part as wide as distance across posterior ocelli inclusive. At the same level, each parafrontal one-half as wide as the frontal vitta. With a row of strong parafrontal bristles and setulae which reach to opposite the anterior ocellus. Vertical bristles scarcely differentiated from the groups of long hairs at vertex. Ocellars not quite so long as the anterior parafrontals. Juncture of parafacials and parafrontals as long as width of third antennal segment, parafacials not narrowed below. Cheeks twice as high as width of third antennal segment, with two or three rows of upwardly directed setulae along ventral margin. Eyes bare. Antennae and palpi black. The palpi slightly compressed so that they appear slightly wider than usual, but the widening is very gradual. Antennae inserted opposite the upper six-tenths of eye. Third antennal segment one and two-thirds times as long as its greatest diameter.

Thorax black, subshiny, sparsely brownish gray pruinescent, indistinctly quadrivittate. Presutural acrostical setulae in seven to eight irregular rows; with a pair of prescutellar acrostical bristles; dorsocentrals 2:4; intra-alars 2; pra one and one-tenth times as long as posterior notopleural bristle; hairs adjacent to base of posterior notopleural bristle. Scutellar setulae extending slightly below level of marginals. Sternopleurals 1:2 to 1:4, the posterior accessory ones shorter but nevertheless distinct. Hypopleura and sternites bare.

Legs black. Fore femora normal. Fore tibiae without median bristles, the clothing setulae slightly finer and longer than usual. Mid femora with long, anteroventral, hair-like setulae on basal third, a row of at least five ventral bristles on basal half which gradually become shorter and finer apically and joining the posteroventral long setulae so as to appear to form a complete row of ventral to posteroventral bristle-like setulae, with a row of slender anterior bristles on basal half and with an apical anterior and anterodorsal bristle. Mid tibiae with two strong median posterior bristles. Hind femora with a complete row of anteroventral bristles which are only slightly longer than the diameter of femora where situated, and a row of shorter posteroventral ones on basal half to two-thirds. Hind tibiae with two strong anterodorsal and two weaker anteroventral bristles on apical half.

Wings slightly smoky brown hyaline, rather yellowish at base. Costal setulae slightly, the thorns moderately, developed. Node hairy dorsally and ventrally but not beyond. Cross veins not infuscated. Third and fourth veins slightly divergent apically. Penultimate section of fourth vein seven-twelfths as long as ultimate. Calyptrae bright yellow. Knobs of halteres dark fuscous to black, stalks light brown to dark orange.

Abdomen subcylindrical, black, grayish pruinescent, with an indistinct dorsocentral vitta. Basal sternite bare; others longer than broad, with a pair of moderately well-developed apicals; fifth moderately cleft, without distinctive armature. Hypopygium black.

FEMALE: Length 6.5 mm. Similar to the male, differing in having the parafacials yellow to brownish pruinescent. Front at vertex four-tenths of head width, with a complete row of parafrontal bristles and strong lateral setulae. Parafacials narrowed below to half the length of juncture of parafacials and parafrontals. Palpi broadened but not so abruptly so. The mid femoral anteroventral setulae are not so long, and there are only two or three ventral bristles. Wings more yellowish to orange at base. Fourth vein more strongly divergent.

The description of the male is based on the holotype from St. George Island, Alaska, in the United States National Museum.

SPECIMENS EXAMINED: Six males and two females from Alaska.

Mydaea palpalis Stein

Mydaea palpalis STEIN, 1916, Arch. Naturgesch., sect. A, vol. 81, p. 56, RINGDAHL, 1924, Ent. Tidskr., vol. 45, p. 44.

MALE: Length 5.5 to 6 mm. Very similar to *hannia* Malloch. Parafacials, parafrontals, and cheeks more brownish, with sparser grayish brown pruinescence. Parafacials narrowed to half the width of third antennal segment below juncture of parafacials and parafrontals. Palpi abruptly widened on apical half. Mid femora with only the apical anterodorsal bristle. Hind tibiae usually with three median posterior bristles. Abdominal pruinescence sparser, distinctly brownish gray.

SPECIMENS EXAMINED: One male, Mt. Washington, New Hampshire, in United States National Museum bearing the label *Mydaea rugia* Walker. This specimen was sent to Herr O. Ringdahl who stated it was identical with European specimens of *Mydaea palpalis* Stein.

Mydaea discimana Malloch

Mydaea discimana MALLOCH, 1920, Trans. Amer. Ent. Soc., vol. 46, p. 136, 1921, Canadian Ent., vol. 53, p. 10; 1932, *ibid.*, vol. 55, p. 221; RINGDAHL, 1936, Opusc. Ent., vol. 2, p. 45.

MALE: Length 7 to 9 mm. Very similar to *urbana* Meigen, differing from it in having the pra absent or not more than one-half the length of posterior notopleural bristle. The fore tarsal segment slightly wider than the apical width of fore metatarsus. There is often a weak lower anterior sternopleural hair-like setula.

FEMALE: Length 9 mm. Like the male, but differing from it in having the front slightly less than one-third of head width, widened anteriorly and with a complete row of parafrontal bristles, the posterior two pair outwardly directed. The fourth and fifth fore tarsal segments more distinctly broadened, especially the fifth.

SPECIMENS EXAMINED: Eleven males and 20 females from New Hampshire, Massachusetts, New York, New Jersey, Colorado, Alberta, Ontario, Quebec, Alaska, Germany, and Finland, including the holotype in Illinois Natural History Survey Collection.

Mydaea discimanoides, new species

FEMALE: Length 8 mm. Very similar to *discimana* Malloch, differing from it in having the juncture of parafacials and parafrontals twice as long as width of third antennal segment, parafacials narrowed to its width below. Cheeks two and one-half times as high as width of third antennal segment. Third antennal segment two and one-half times as long as second.

Thorax with distinctly bluish gray pruinescence, with four broad black vittae. Sternopleurals 2:2. Fore coxae, all tarsi, and fore femora infuscated, rest of legs fulvous. Apical fore tarsal segment greatly, and the apical three mid tarsal segments slightly, broadened. Fore tibiae without median bristles. Wings and calyptrae almost white, hyaline.

Abdomen black, with dense bluish gray pruinescence, with very distinct dorsal and lateral checkerings and a dorsocentral vitta.

TYPE MATERIAL: Holotype, female, Bear Wallow, St. Catalina Mountains, Arizona, July 12–17, 1912 (latitude 32° 25.3′ N., longitude 110° 44′ W.), about 8000 feet.

Mydaea urbana (Meigen)

Musca angelicae FALLÉN (*nec* Scopoli), 1825, Muscides, p. 78.

Anthomyia urbana MEIGEN, 1826, Systematische Beschreibung der bekannten Europäischen zweiflügeligen Insekten, vol. 5, p. 118.

? *Fellaea florea* ROBINEAU-DESVOIDY, 1830, Mem. Acad. Roy. Sci. France, ser. 2, vol. 2, p. 477.

? *Mydaea musca* ROBINEAU-DESVOIDY, 1830, Mem. Acad. Roy. Sci. France, ser. 2, vol. 2, p. 481.

? *Aricia orthoneura* MACQUART, 1835, Histoire naturelle des insectes, diptères, vol. 2, p. 292.

Aricia urbana MACQUART, 1835, Histoire naturelle des insectes, diptères, vol. 2, p. 292; PANDELLÉ, 1899, Rev. Ent. France, vol. 18, p. 87.

Spilogaster urbana SCHINER, 1862, Fauna Austriaca, vol. 1, p. 612.

Mydaea urbana STEIN, 1914, Arch. Naturgesch., sect. A, vol. 79, p. 21; 1916, *ibid.*, sect. A, vol. 81, p. 69; MALLOCH, 1921, Canadian Ent., vol. 53, p. 9; 1923, *ibid.*, vol. 55, p. 220; RINGDAHL, 1924, Ent. Tidskr., vol. 45, p. 42.

MALE: Length 8 mm. Head black, silvery gray pruinescent. Front at narrowest part as wide as distance across posterior ocelli inclusive. Parafrontals contiguous, with a series of bristles and setulae extending to anterior apex of ocellar triangle. Juncture of parafacials and parafrontals three-fourths as long as the narrowest width of third antennal segment. Eyes bare. Antennae and palpi black, second segment sometimes light brown at apex. Third antennal segment two to two and one-fourth times as long as second. Longest hairs on arista as long as width of third antennal segment.

Thorax black, yellowish gray pruinescent, distinctly quadrivittate. Presutural acrostical setulae in nine to 10 irregular rows; with a pair of strong prescutellar acrostical bristles; dorsocentrals 2:4; intra-alars 2; pra distinctly longer than either notopleural bristle, fully three-fourths as long as bristle behind it and equal in length to the first postsutural dorsocentral; with a few setulae adjacent to posterior notopleural bristle. Scutellar setulae descending below level of marginals but not invading ventral surface. Sternopleurals 1:2. Hypopleura with setulae above base of hind coxae.

Coxae, trochanters, and tarsi and often fore femora and basal third of mid femora partly or entirely black, rest of legs yellow. Fore femora normal. Fore tibiae usually bare in the middle. Mid femora with four to six ventral bristles on basal half, the anterior surface without well-developed bristles, with only the apical anterodorsal bristle. Mid tibiae with two to four median posterior bristles. Hind femora with a complete row of anteroventral bristles which are most distinct on apical half, those on basal half not more than one-half as long as diameter of femora where situated. Hind tibiae with two median anteroventral and anterodorsal bristles, occasionally with a few weak, median, posterior setulae.

Wings yellowish hyaline. Third and fourth veins distinctly divergent apically. Costal setulae and thorns not noticeably developed. Calyptrae and halteres yellow.

Abdomen black, with dense yellowish gray pruinescence, a moderately distinct darkened narrow dorsocentral vitta and indistinct dorsal and lateral checkerings. Basal sternite bare; others with a strong pair of apical bristles; fifth distinctly cleft, with two to four well-developed bristles in the middle of the disc of processes. Hypopygium black.

FEMALE: Length 9 mm. Very similar to the male, differing from it in having the front at vertex one-third of head width and only slightly widened anteriorly. Usually all the femora yellow. The abdomen with more distinct dorsal and lateral checkerings.

SPECIMENS EXAMINED: Twenty-one males and 10 females from Quebec, New York, Maryland, North Carolina, Michigan, Finland, Germany, the Netherlands, and France. The European specimens were determined by Stein, Karl, Tiensuu, and De Meijere.

Mydaea persimilis Malloch

Mydaea persimilis Malloch, 1920, Trans. Amer. Ent. Soc., vol. 46, p. 134; 1921, Canadian Ent., vol. 53, p. 9; 1923. *ibid.*, vol. 55, p. 223.

Mydaea furtiva Stein, 1920, Arch. Naturgesch., sect. A, vol. 84, p. 32.

Male: Length 7 to 8 mm. Very similar in color and bristling to *urbana* Meigen, differing from it in having the longest aristal hairs scarcely longer than greatest diameter of arista. Hind femora with a row of bristles on basal half of posteroventral surface; the bristles on basal half of anteroventral surface almost as long as diameter of femora where situated. Front at narrowest part only slightly wider than diameter of anterior ocellus.

Female: Length 7.5 to 8 mm. Similar to the male, differing from it in having the front at vertex slightly less than one-third of head width, almost parallel sided. Fore femora not infuscated. Hind femora with only a few bristles at base of posteroventral surface. Palpi distinctly broadened apically.

Specimens Examined: Seven males and six females from Alaska, Alberta, Washington, and California, including the holotype. The specimen from Washington bears the label *Mydaea urbana* and a typewritten label "returned by Enderlein."

In addition to the above characters, *persimilis* in both sexes also differs from *urbana* in possessing some moderately well-developed bristles on basal half of mid femora on the anterior surface and in lacking hairs at base of the hind coxae on the hypopleura.

I have not seen the type of *Mydaea furtiva* Stein, a female, but I have no hesitation in placing it as a synonym of this species, since the description agrees almost perfectly with the type of *persimilis*.

Mydaea brevipilosa Malloch

Mydaea brevipilosa Malloch, 1920, Trans. Amer. Ent. Soc., vol. 56, p. 135.

Male: Length 7 mm. Very similar to *urbana* Meigen, differing from it in having the second antennal segment light orange. Longest hairs on arista two to two and one-half times as long as its greatest diameter. The femora and trochanters entirely yellowish. Mid femora with well-developed basal anterior bristles, the basal anteroventral bristles not so well developed as those at apex. Otherwise as in *urbana*.

Female: Length 7.5 mm. Very similar to the male, differing from it in having the front at narrowest one-third of head width, almost parallel sided.

Specimens Examined: Four males and three females from Illinois, Wisconsin, Massachusetts, and Quebec, including the holotype in Illinois Natural History Survey Collection.

The shorter-haired arista and the entirely yellowish femora as well as the absence of hairs on the hypopleura above hind coxae should readily distinguish the male of this species from *urbana*. It may be distinguished from the other species resembling *urbana* which have short-haired arista by the longer pra and the lack of posteroventral bristles on hind femora.

Mydaea electa (Zetterstedt)

Anthomyza electa Zetterstedt, 1860, Diptera Scandinaviae, vol. 14, p. 6371; Stein, 1902, Wiener Ent. Zeitg., vol. 21, p. 46; Ringdahl, 1939, Opusc. Ent., vol. 4, p. 154.

Spilogaster electa Strobl, 1893, Verhandl. Zool. Bot. Gesellsch. Wien, vol. 43, p. 222.

Mydaea electa Ringdahl, 1924, Ent. Tidskr., vol. 45, p. 43; Karl, 1929, Zool. Anz., vol. 80, p. 276.

Male: Length 7 mm. Head black, grayish pruinescent. Front at narrowest part twice as wide as diameter of anterior ocellus. Parafrontals narrowly contiguous, the contiguous portion being only about one-tenth the length of the front, with about 10 pairs of parafrontal bristles. Juncture of parafacials and parafrontals about one-half as long as width of third antennal segment; parafacials scarcely narrowed below. Cheeks about one and one-fourth times as high as width of third antennal segment. Eyes bare or with a few very short, sparse hairs. Antennae and palpi black, the second segment sometimes slightly brownish at apex, third segment twice as long as second. Longest aristal hairs as long as, or slightly longer than, width of third antennal segment.

Thorax black, grayish to yellowish gray pruinescent, with four narrow but distinct vittae. Dorsum bristled as in *urbana*, except that the pra is only one-half as long as posterior notopleural bristle. Sternopleurals 2:2, the lower anterior one somewhat weaker but always distinct.

Legs black, the tibiae and sometimes the apical one-eighth or less of femora dark fulvous, occasionally the bases of the tibiae darkened. Fore femora normal. Fore tibiae bare at middle. Mid femora with four or five strong ventral bristles on basal half, the anterior row scarcely developed and with an apical anterodorsal bristle. Mid tibiae with three posterior bristles. Hind femora with a complete row of anteroventral bristles and occasionally one or two short posteroventral setulae on basal fourth. Hind tibiae with two median anterodorsal and anteroventral bristles.

Wings yellowish hyaline, the yellow tinge more distinct towards base. Third and fourth veins slightly divergent at apices. Calyptrae and halteres yellow.

Abdomen black, rather golden yellow pruinescent, with moderately distinct dorsal and lateral checkerings and a dorsocentral vitta. Basal sternite bare; fifth rather distinctly cleft, without distinct long bristles. Hypopygium black.

SPECIMENS EXAMINED: One male from Finland determined by Ringdahl and 11 males from New Hampshire and New York.

Mydaea neglecta Malloch

Mydaea neglecta MALLOCH, 1920, Trans. Amer. Ent. Soc., vol. 46, p. 136.

MALE: Length 7 to 8 mm. Very similar to *electa* Zetterstedt, of which it may ultimately prove to be a subspecies. It differs from it in having the legs yellow, only the coxae, tarsi, and basal half to three-fourths of fore femora infuscated. The anteroventral bristles on basal half of hind femora absent or setulose. Sternopleurals usually 2:2, occasionally with the lower anterior one very much reduced or absent.

FEMALE: Length 7 to 8.5 mm. Similar to the male, differing from it in having the front at vertex one-fifth of head width. Second antennal segment slightly brownish to dark fulvous. The femora and tibiae entirely fulvous. Sternopleurals frequently 1:2 instead of 2:2.

SPECIMENS EXAMINED: Eight males and 10 females from Massachusetts, Connecticut, New York, New Jersey, Maryland, Pennsylvania, Wisconsin, and Ontario, including the holotype in the Illinois Natural History Survey Collection.

Mydaea narona, new species

MALE: Length 6.5 mm. Head black, brownish pruinescent. Front at narrowest part about one-half as wide as diameter of anterior ocellus, the parafrontals broadly contiguous, with five or six pairs of bristles reaching only to narrowest part of front. Juncture of parafacials and parafrontals as long as one-third the width of third antennal segment or about twice as long as greatest aristal diameter. Cheeks as high as width of third antennal segment. Eyes bare, very large, the facets enlarged above in front, but the eyes are not flattened above. Antennae and palpi black, second antennal segment slightly lighter colored at apex. Third antennal segment at least three and three-fourths times as long as second, slender. Antennae inserted at middle of eyes. Longest aristal hairs about one and one-fourth times as long as width of third antennal segment.

Thorax black, with sparse, slightly yellowish gray pruinescence, with two narrow, but distinct median, and two less distinct but broader, lateral dark vittae. Bristled as in *nubila* Stein except the hypopleura has two or three hairs above hind coxae.

Legs brown, the tibiae and apices of femora fulvous. Fore femora normal. Fore tibiae without median bristles. Mid femora with a row of short anterior bristles on basal one-half and a more complete row of longer ventral bristles, and with an apical anterior and anterodorsal bristle. Mid tibiae with two median posterior bristles. Hind femora with a complete row of anteroventral bristles which are longer than femoral diameter on apical one-third and a row of posteroventral bristles on basal three-fourths. Hind tibiae with two median anterodorsal and anteroventral bristles.

Wings yellowish hyaline. Costal setulae and thorns undeveloped. Cross veins not infuscated, the posterior one straight. Third and fourth veins subparallel at apices. Calyptrae and halteres brownish yellow.

Abdomen black, with rather sparse, slightly yellowish gray pruinescence, with very indistinct dorsal and lateral checkerings but with a very narrow but distinct dorsocentral vitta. Basal sternite bare; others with a distinct pair of apical bristles; fifth slightly shiny, moderately cleft, with three or four short bristles on inner margin of each process. Hypopygium black.

FEMALE: Length 6.5 to 7 mm. Similar to the male, differing from it in having the front at vertex a little over one-fourth of head width, slightly widened anteriorly. With a complete row of parafrontal bristles, the anterior three inwardly, the posterior two outwardly, directed. Juncture of parafacials and parafrontals about as long as width of third antennal segment. Eye facets not enlarged. Antennae inserted opposite dorsal two-thirds of eye. Third antennal segment about three times as long as second. Apices of femora more extensively fulvous and the tibiae lighter fulvous. Abdomen slightly shiny, very sparsely pruinescent.

TYPE MATERIAL: Holotype, male, Plummers Island, Maryland, August 6, 1915 (R. C. Shannon); allotype, female, and paratype female, Cabin John, Maryland, June 9, 1923 (J. M. Aldrich); in the United States National Museum.

Mydaea winnemana Malloch

Mydaea winnemana MALLOCH, 1919, Proc. Biol. Soc. Washington, vol. 32, p. 133; 1921, Canadian Ent., vol. 53, p. 9; 1923, *ibid.*, vol. 55, p. 220.

MALE: Length 5 to 6 mm. Similar to *neobscura*, new species, differing from it in having the parafacials, parafrontals, and cheeks silvery gray pruinescent. The front at narrowest part not quite so wide as distance across posterior ocelli inclusive, parafrontals broadly contiguous; each parafrontal about as wide as anterior ocellus. Third antennal segment twice as long as second; base of third segment light brown to fulvous, rest of antennae and palpi infuscated. Eyes with not such enlarged facets.

Thorax with but two very narrow dorsocentral vittae which are visible only on presutural portion. Without the weak anterior sternopleural setula. Hypopleura with hairs above hind coxae.

Legs more extensively fulvous yellow, fore and variable portions of the mid and hind femora infuscated. Hind femora with the anteroventral bristles on basal half shorter, not longer than diameter of femora where situated, and with only four or five posteroventral bristles on basal half. Calyptrae white or with a very faint yellowish tinge; halteres yellow.

FEMALE: Length 5 to 6 mm. Similar to the male, differing from it in having the front at vertex one-fourth of head width, distinctly widened anteriorly. Palpi distinctly broadened. Third antennal segment longer and broader than usual, almost three times as long as second, the thoracic vittae more distinct. Bristles on hind femora less numerous but stronger.

SPECIMENS EXAMINED: Thirty-three males and 10 females from Virginia, North Carolina, and Florida.

I believe that I have correctly identified this species but cannot be sure until the type can be examined. An extensive search for it in the United States National Museum where it was stated to be deposited failed to reveal it.

Mydaea neobscura, new species

MALE: Length 5.5 mm. Head black, grayish white pruinescent. Front at narrowest part as wide as distance across posterior ocelli inclusive; the parafrontals subcontiguous. With a row of about eight parafrontal bristles which become gradually shorter posteriorly, extending to narrowest part of front. Anterior ocellar bristles as strong as the anterior parafrontals. Juncture of parafacials and parafrontals as long as width of third antennal segment, parafacials slightly narrowed below. Cheeks slightly higher than width of third antennal segment. Antennae black, the second segment very dark brown. Third segment two and one-fifth times as long as second. Longest aristal hairs as long as width of third antennal segment. Palpi deep brown to black. Eyes bare, facets slightly enlarged in front in center.

Thorax black, grayish pruinescent, with four broad black vittae. Presutural acrostical setulae in four to six regular rows. Acrosticals 0:1; dorsocentrals 2:4; pra slightly less than one-half as long as posterior notopleural bristle. Notopleura with hairs adjacent to posterior bristle. Scutellar setulae descending slightly below level of marginal bristles. Sternopleurals 2:2, the lower anterior sternopleural setula is very weak but nearly always distinct. Hypopleura usually bare above hind coxae.

Legs infuscated, apices of femora and tibiae dark fulvous. Fore femora normal. Fore tibiae without median bristles. Mid femora with anterior setulae scarcely distinguishable from clothing setulae, with a row of very short anteroventral bristles and a row of much stronger ventral bristles on basal one-half. With a single, rather weak, apical, subanterodorsal setula. Mid tibiae with two median posterior bristles. Hind femora with a row of anteroventral bristles on apical half, only the most apical ones longer than femoral diameter, at most one or two weak, basal, posteroventral setulae. Hind tibiae with two median anterodorsal and anteroventral bristles.

Wings very pale yellowish hyaline. Third and fourth veins moderately divergent apically. Posterior cross vein moderately curved. Calyptrae white, halteres fulvous.

Abdomen black, densely grayish pruinescent. With distinct median vitta, dorsal and lateral checkerings. Basal sternite bare, other with strong apicals. Fifth moderately cleft, without distinctive armature.

FEMALE: Length 6 mm. Similar to the male. Front at vertex five-sixteenths of head width, widened to six-sixteenths anteriorly. Second antennal segment fulvous brown at apex. Third antennal segment about two and one-half times as long as second. Legs lighter brown. Mid femora without anteroventral setulae and only two or three ventral bristles.

TYPE MATERIAL: Holotype, male, Raleigh, North Carolina, April 24, 1923 (C. S. Brimley); allotype female, topotypical, August 14, 1930; paratypes: one male, Lafayette, Indiana, August 5 (J. M. Aldrich), three females, Madison, Wisconsin, September 6, 1935 (F. M. Snyder), Cabin John, Maryland, May 19, 1923 (J. M. Aldrich), Plummers Island, Maryland, June 20, 1912 (H. Barber).

ADDITIONAL RECORDS: White Mountains, New Hampshire, and Miribea Hills, New Jersey.

This is the species that I had identified as *obscura* Stein before examining the type. It is recorded as such in Brimley's list of North Carolina insects.

Mydaea nubila Stein

Spilogaster obscura STEIN (*nec* Van der Wulp), 1897, Berliner Ent. Zeitschr., vol. 62, p. 197; CZERNY, 1901, Wiener Ent. Zeitg., vol. 20, p. 43.

Mydaea nubila STEIN, 1916, Arch. Naturgesch., sect. A, vol. 81, p. 65; 1918, *ibid.*, sect. A, vol. 81, p. 39.

Mydaea obscura MALLOCH, 1921, Canadian Ent., vol. 53, p. 9; 1923, *ibid.*, vol. 55, p. 220.

MALE: Length 6 to 7 mm. Head black, silvery gray pruinescent. Front at narrowest part as wide as distance across posterior ocelli inclusive. Parafrontals contiguous or subcontiguous; if subcontiguous, the frontal vitta at narrowest part less than one-half as wide as diameter of anterior ocellus; with about eight pairs of bristles and setulae which extend to narrowest part of front. Juncture of parafacials and parafrontals three-fourths as long as greatest width of third antennal segment, parafacials scarcely narrowed below. Cheeks one and one-fourth times as high as greatest width of third antennal segment. Eyes bare. Antennae black, reaching a little below level of lower margin of eyes. Third antennal segment two and one-fourth times as long as second. Longest aristal hairs as long as narrowest width of third antennal segment. Palpi black.

Thorax black, slightly shiny, sparsely grayish pruinescent, very indistinctly quadrivittate. Presutural acrostical setulae in six to eight irregular rows and with a pair of prescutellar acrostical bristles; dorsocentrals 2:4; the pra not more than three-fourths as long as posterior notopleural bristle and not more than half as long as first postsutural notopleural bristle. Hypopleura hairy above hind coxae. Sternopleurals 1:2.

Legs black, the tibiae black to slightly brownish. Fore femora normal. Fore tibiae bare at middle. Mid femora with a series or five or six well-developed ventral bristles on basal half and a much weaker and less distinct series on basal half of anterior surface; with an apical anterior and anterodorsal bristle. Mid tibiae with two median posterior bristles. Hind femora with a complete row of anteroventral bristles and a row of shorter ones on basal half of posteroventral surface, only those on apical half of anteroventral surface as long as diameter of femora where situated. Hind tibiae with two median anterodorsal and anteroventral bristles.

Wings hyaline, slightly yellowish brown at base. Costal thorns and setulae scarcely developed. Third and fourth veins slightly divergent at apices. Calyptrae yellowish hyaline. Halteres deep orange to black.

Abdomen black with sparse yellowish gray pruinescence. When viewed from behind, with an indistinct dark dorsocentral vitta and without distinct lateral or dorsal checkerings. Basal sternite bare; fifth moderately cleft, without distinctive armature. Hypopygium black.

FEMALE: Length 6 mm. Very similar to the male, differing from it in having the front at vertex one-third of head width, slightly widened anteriorly. The apical anterodorsal bristle of mid femora not so well developed as the apical anterior bristle. Abdomen with very slight dorsal and lateral checkerings and without as distinct pruinescence.

SPECIMENS EXAMINED: One male, Pennsylvania, type of *obscura* Stein (Hough collection, Chicago Natural History Museum); two males, Genthin, Germany, determined as *nubila* Stein (Zoological Museum, University of Berlin); two males, New York, determined as *nubila* Stein (Zoological Museum, University of Berlin); six males and one female, Washington, Oregon, New Mexico, and Quebec.

The two Genthin specimens are labeled "typ," but I do not consider these specimens to be authentic types since Stein, originally describing the species under the name *obscura*, mentioned a single male from Pennsylvania. The specimen from Pennsylvania listed above should be the holotype.

There has been considerable confusion regarding the identification of this species. Specimens having the femora broadly yellowish at apices and the tibiae entirely so have been identified by various workers as *obscura* or *nubila*. I am of the opinion that these specimens have in reality been one of several closely related species. As herein considered, *nubila* is limited to those specimens having the legs mostly or entirely black to brownish, dark halteres and with two apical bristles on mid femora and with a complete row of anteroventral bristles and a partial row on basal half of posteroventral surface of hind femora.

Mydaea obscurella Malloch

Mydaea obscurella MALLOCH, 1921, Canadian Ent., vol. 53, p. 108

MALE: Length 6.5 mm. Similar to *nubila* Stein, differing from it in having the parafacials, parafrontals, and cheeks distinctly brownish pruinescent. The parafrontal bristles and setulae longer and more distinct, reaching all the way to the anterior ocellus. Juncture of parafacials and parafrontals three-fourths as long as greatest width of third antennal segment, parafacials narrowed to half this width below. Longest aristal hairs three-fourths as long as width of third antennal segment or four times as long as greatest aristal diameter.

Thorax shiny and sparsely pruinescent as in *nubila*, but the pruinescence is more brownish.

Legs as in *nubila*, except the mid femora lacks the apical anterior bristle. Hind tibiae with two or three median anterodorsal and anteroventral bristles.

Wings more brownish hyaline, especially at base. Calyptrae distinctly yellowish to light orange. Halteres pale yellow to light orange.

Abdomen with more distinct yellowish brown pruinescence and dorsal and lateral checkerings.

FEMALE: Length 7.5 mm. Similar to the male, differing from it in having the front at vertex one-third of head width, scarcely widened anteriorly. With a complete row of parafrontal bristles, the posterior two outwardly, the others inwardly, directed and with numerous setulae, rather longer than usual, laterad to them all. Fore tibiae with one or two median posterior bristles. Hind femora without posteroventral bristles. Wings more yellowish hyaline.

SPECIMENS EXAMINED: Seven males and five females from Alaska, British Columbia, and Idaho.

The distinctly shiny and indistinctly quadrivittate thorax as well as the entirely black legs in the male should at once distinguish this species from *electa* and *narona*. However, it is not so easily separated from *nubila* Stein except by characters mentioned in the keys. It is also similar to the European species *bengstssoni* Ringdahl (1924, p. 44), but the latter has a median posterior bristle on the fore tibiae.

GENUS **XENOMYDAEA** MALLOCH

Xenomydaea MALLOCH, 1920, Trans. Ent. Soc. Amer., vol. 46, p. 144.

As far as is known, this genus is limited to the Holarctic regions. Except for the head shape, when viewed in profile, I have been able to find no reliable characters to separate it from *Mydaea*. The only species known to me which might connect *Mydaea* with it is *armatipes* Malloch. It should not be confused with any species at present placed in *Xenomydaea* or *Mydaea* because of the presence of ventral bristles on fore and mid tibiae. *Xenomydaea nudiseta* Stein has a submedian ventral bristle on mid tibiae, but the two species can be easily separated by other characters.

The genotype of *Xenomydaea* is *buccata* Malloch.

KEY TO *Xenomydaea*

1. Halteres, margins of calyptrae, and base of wings black; bluish black species with whitish pruinescence; sternopleurals 2 : 2 or 2 : 3 .... *fuscomarginata* (Malloch)
   Halteres, margins of calyptrae, and base of wings not blackish; dark but not shiny species and without whitish pruinescence; sternopleurals 1 : 2 except in *buccata* 2
2. Sternopleurals 2:2; all tibiae and mid and hind femora partly or entirely fulvous .... *buccata* Malloch
   Sternopleurals 1 : 2; at most hind tibiae yellow to fulvous 3

3. Fore tibiae without a median posterior bristle; hind femora without posteroventral bristles.................. ....*pogonoides*, new species
   Fore tibiae with a median posterior bristle; hind femora with posteroventral bristles at base............. 4
4. Mid tibiae with a median to submedian posteroventral bristle; hind tibiae fulvous; dorsocentrals usually 2 : 3; base of wing pale yellow........ ....*nudiseta* (Stein)
   Mid tibiae without a median to submedian posteroventral bristle; hind tibiae black; dorsocentrals 2 : 4; base of wings intensely yellow to fulvous........................ . ...*rufinervis* (Pokorny)

Xenomydaea fuscomarginata (Malloch)

Helina fuscomarginata MALLOCH, 1919, Proc. California Acad. Sci., ser. 4, vol. 9, p. 298.

Mydaea pulla STEIN, 1920, Arch. Naturgesch., sect. A, vol. 84, p. 35.

MALE: Length 8.5 mm. Head black, brownish pruinescent. Front at narrowest part scarcely as wide as the distance across posterior ocelli inclusive. Parafrontals at this level not so wide as diameter of anterior ocellus, with a row of about 10 strong bristles and an equal number of shorter setulae which extend to the level of the shiny black ocellar triangle. Juncture of parafacials and parafrontals as long as length of third antennal segment or one and one-half times its greatest width, parafacials slightly narrowed below. Cheeks one-third of eye height and about two and one-half times as high as width of third antennal segment, distinctly retreating below. Lower margin with two or three rows of strong, upwardly curved bristles. Front distinctly protruded beyond level of vibrissae. Eyes distinctly haired. Antennae and palpi black, the former inserted opposite middle of eyes, extending to a level of the lower margin of eyes. Third antennal segment one and one-half times as long as second. Longest hairs on arista not so long as its greatest diameter.

Thorax bluish black, whitish gray pruinescent, distinctly quadrivittate. Presutural acrostical setulae in eight to 10 irregular rows; with a pair of prescutellar acrostical bristles; dorsocentrals 2:4; intra-alars 2; pra almost as long, but not so strong, as posterior notopleural bristles; with distinct hairs on notopleura adjacent to base of posterior bristle; scutellar setulae descending slightly below level of marginals. Sternopleurals 2:2, often with several quite well-developed accessory bristles in the posterior group so that the sternopleurals sometimes appear to be 2:3 or 2:4; sternites and hypopleura bare.

Legs entirely black. Fore femora normal. Fore tibiae bare in the middle. Middle legs as in *buccata* Malloch. Hind femora with a complete row of anteroventral and a row of posteroventral bristles on the basal third to half. Hind tibiae with two or three median anterodorsal and anteroventral bristles.

Wings brownish hyaline, almost black at base. Costal thorns slightly developed, costal setulae undeveloped. Third and fourth veins distinctly divergent at apices. Node distinctly hairy below and with one or two hairs on the upper surface. Cross veins slightly infuscated. Halteres black, calyptrae margined with black, the disc whitish to yellowish hyaline.

Abdomen distinctly bluish black, with bluish gray pruinescence, with a distinct pair of black spots on second and a weaker pair of third visible tergites. Basal sternite bare; others with moderately long bristles or setulae; fifth only moderately cleft, without distinctive armature. Hypopygium black.

SPECIMENS EXAMINED: One male cotype of *pulla* Stein, California, United States National Museum. I have not seen the type of *fuscomarginata* which is in the Stanford University collection.

Malloch originally placed this species in *Helina*, but the strongly protuberant and moderately widened front, almost bare arista, and hairs on the node, at least below, would indicate that it is much more closely related to *buccata* Malloch, the genotype of *Xenomydaea*, than to *pertusa* Meigen, the genotype of *Helina*.

Xenomydaea buccata Malloch

Xenomydaea buccata MALLOCH, 1920, Trans. Ent. Soc. Amer., vol. 46, p. 144.
Mydaea otiosa STEIN, 1920, Arch. Naturgesch., sect. A, vol. 84, p. 34.

MALE: Length 7.5 mm. Head black, grayish pruinescent. Front at narrowest part about one-fifth of head width and twice as wide as distance across posterior ocelli inclusive. Frontal vitta at narrowest part as wide as length of second antennal segment, almost parallel sided. Parafrontals at narrowest part as wide as diameter of anterior ocellus, with six to eight pairs of bristles which extend to the ocellar triangle. Parafacials and parafrontals distinctly protruded, juncture as long as the length of third antennal segment from its apex to base of the arista; parafacials distinctly narrowed below, at narrowest part scarcely as wide as width of third antennal segment. Oral margin slightly produced. Cheeks as high as length of third antennal segment, with two or three rows of upwardly directed short bristles and setulae, lower margin slightly retreating. Eyes bare or with only very short, sparse, scarcely discernible hairs. Antennae and palpi black. Third antennal segment one and one-fourth times as long as second. Longest hairs on arista not longer than its greatest diameter.

Thorax black, slightly brownish gray pruinescent, distinctly quadrivittate. Presutural acrostical setulae in eight to 10 irregular rows and with a distinct pair of prescutellar acrostical bristles, dorsocentrals 2:3 or 2:4; intra-alars 2; pra three-fourths as long as posterior notopleural and about one-half as long as the bristle behind it; with distinct hairs on notopleura near base of posterior bristle. Scutellar setulae descending slightly below level of marginals. Sternopleurals 2:2. Hypopleura bare.

Coxae and tarsi black, tibiae yellow to orange, the knees of fore and mid femora and hind femora to a greater extent, yellowish to orange, rest of femora variably darkened. Fore femora normal. Fore tibiae without median bristles. Mid femora with six to 10 ventral bristles on basal half to two-thirds, with a row of much shorter bristles on basal half of anterior surface and with one apical anterior bristle. Mid tibiae with two or three median posterior bristles. Hind femora with a complete row of anteroventral bristles which are longest towards apex, apex of posteroventral surface with two or more short but distinct bristles which are about as long as diameter of femora where situated. Hind tibiae with two median anterodorsal and three median anteroventral bristles.

Wings infuscated at base Costal thorns moderately well developed, setulae undeveloped. Node hairy above and below. Other veins bare. Third and fourth veins distinctly divergent at apices. Calyptrae and halteres yellow.

Abdomen black, yellowish gray pruinescent, with moderately distinct, paired, subtriangular spots on second to fourth visible tergites. Basal sternite bare; fifth distinctly cleft, with a few short, closely placed bristles at base of processes. Hypopygium black.

FEMALE: Length 7.5 to 8 mm. Quite similar to the male, differing from it in having the front one-third of head width at vertex, scarcely widened anteriorly. Parafrontals with numerous short setulae laterad to the row of bristles, the posterior two pair of bristles outwardly directed.

The femora not so distinctly infuscated. Mid and hind femora usually entirely yellow. Hind femora without conspicuous, weak, apical, posteroventral bristles. Wings more yellowish hyaline. Abdomen without as distinct spots but with distinct dorsal and lateral checkerings.

SPECIMENS EXAMINED: Five males and three females from Idaho, Montana, Colorado, and New Hampshire, including the holotype in the Illinois Natural History Survey Collection.

There is considerable variation in the femoral coloring in the above series of specimens. In the majority of them, the fore femora is largely infuscated, while the mid and hind femora are less distinctly infuscated.

Buccata should be readily separated from all the others at present placed in *Xenomydaea* by the less strongly produced oral margin as well as the more yellowish mid and hind femora.

Xenomydaea pogonoides, new species

MALE: Length 7.5 mm. Head black, silvery gray pruinescent with slightly reddish reflections. Front at narrowest part slightly less than two times as wide as the distance across posterior ocelli inclusive. Frontal vitta at narrowest part slightly wider than the distance across posterior ocelli inclusive. Parafrontals at narrowest part as wide as diameter of anterior ocellus, with about 10 pairs of bristles which extend to the level of the anterior ocellus and with a few weaker setulae interspersed between them. Juncture of parafacials and parafrontals as long as greatest width of third antennal segment, parafacials scarcely narrowed below. Oral margins distinctly protruded. Cheeks as high as length of third antennal segment, with two or three rows of upwardly directed bristles and setulae. Vibrissal angles slightly convergent. Antennae and palpi black. Longest hairs on arista not so long as its greatest diameter. Eyes bare.

Thorax black, slightly bluish gray pruinescent, distinctly quadrivittate. Presutural acrostical setulae in six to eight irregular rows and with a distinct pair of prescutellar acrostical bristles. Dorsocentrals 2:4; intra-alars 2; pra slightly longer than posterior notopleural bristle and almost two-thirds as long as the bristle behind it; notopleura with hairs adjacent to the posterior bristle. Scutellar setulae descending slightly below level of marginals. Sternopleurals 1:2; hypopleura bare.

Legs black. Fore femora normal. Fore tibiae bare in the middle. Mid legs as in *buccata*. Hind femora with a complete row of anteroventral bristles. Hind tibiae with one median anterodorsal and two median anteroventral bristles.

Wings hyaline, slightly orange at base. Costal setulae and thorns undeveloped. Node with a few weak setulae above and below; other veins bare. Third and fourth veins distinctly divergent at apices. Calyptrae and halteres yellow to orange.

Abdomen black, bluish gray pruinescent with scarcely discernible paired spots on second and third visible tergites, with distinct lateral checkerings. Basal sternite bare; fifth moderately cleft. Hypopygium black.

HOLOTYPE: Male, Mt. Rainier, Sluiskin, July 28, 1922 (A. L. Melander), United States National Museum.

It is with some hesitation that I place this species in *Xenomydaea*, since the front is not distinctly protruded in profile. However, the rather broad front, protuberant oral margin, almost bare arista, hairs at base of notopleural bristle, and the hairy node above and below would seem to indicate that it is most closely related to this group.

It may be distinguished from all others by the very protuberant oral margin and more numerous parafrontal bristles.

Xenomydaea rufinervis (Pokorny)

Spilogaster rufinervis POKORNY, 1889, Verhandl. Zool. Bot. Gesellsch. Wien, vol. 39, p. 554.

Mydaea rufinervis BEZZI AND STEIN, 1907, Katalog der Paläarktischen Dipteren, vol. 3, p. 647; STEIN, 1916, Arch. Naturgesch., sect. A, vol. 81, p. 63; BEZZI, 1918, Mem. Soc. Italiana Sci. Nat. e Mus. Civ. Stor. Nat. Milano, vol. 9, p. 117.

MALE: Length 9 mm. Head black, brownish gray pruinescent. Front at narrowest part about as wide as length of antennae or one-fifth of head width. Frontal vitta of almost equal width throughout, twice as wide as distance across posterior ocelli inclusive. Parafrontals at narrowest part slightly wider than diameter of anterior ocellus, with a complete row of bristles which become shorter opposite anterior ocellus, the posterior ones not outwardly directed and without accessory hairs. Juncture of parafacials and parafrontals not quite so long as length of third antennal segment, parafacials only slightly narrower below. Greatest height of cheeks equal to length of antennae and about one-third of head height. Ventral margin of head quite strongly retreating so that if a straight line were drawn from the lower margin of eye anteriorly, the cheeks at narrowest would be only slightly wider than width of third antennal segment. Eyes bare or with very short sparse hairs. Antennae and palpi black, third segment of the former twice as long as second, descending to lower margin of eyes. Longest hairs on arista not so long as its greatest diameter.

Thorax black, grayish pruinescent, with four moderately distinct vittae. Presutural acrostical setulae in seven to 10 irregular rows, with a distinct pair of prescutellar acrostical bristles. Dorsocentrals 2:4; intra-alars 2; notopleura with several setulae at base of posterior bristle; pra fully as long as posterior notopleural bristle, over one-half as long as bristle behind it and the first postsutural dorsocentral. Sternopleurals 1:2; hypopleura bare. Metathoracic spiracle small, with short hairs. Scutellar setulae quite short and widely scattered, descending below level of marginals.

Legs black, at most hind tibiae dark brown. Fore femora normal. Fore tibiae with a median posterior bristle. Mid femora with a number of short anterior bristles on basal half and with a row of eight or nine ventral bristles on basal two-thirds and an apical anterior bristle. Mid tibiae with three median posterior bristles. Hind femora with a complete row of anteroventral bristles which become distinctly longer and stronger towards apex and with a partial row of posteroventral bristles on basal half or more which are equal in development to those on basal half of anteroventral surface. Hind tibiae with two or three median anterodorsal and two median anteroventral bristles.

Wings yellowish hyaline, deep orange at base, concolorous with halteres and calyptrae. Costal setulae minute, thorns moderately developed. Third and fourth veins strongly divergent at apices. Node with a few hairs above and below, other veins bare. Cross veins not infuscated.

Abdomen black, grayish yellow pruinescent, when veiwed from behind, with a distinct, narrow, dark dorsocentral vitta and distinct dorsal and lateral checkerings. Basal sternite with a few hairs; others with short setulae and a distinct pair of apical bristles; fifth distinctly cleft and with three or four moderately long bristles at base of each process. Hypopygium black.

FEMALE: Length 9 mm. Similar to the male. Front wider than the eye, slightly more than one-third of head width, parafrontals with a complete row of bristles, the posterior pair outwardly directed, and with two or three rows of accessory hairlike setulae below the bristles. The lower margin of head not so strongly retreating as in male.

Abdomen with a less distinct dorsocentral vitta, and the pruinescence has a slight bluish tinge. The tergal bristles almost or quite as well developed as in the male.

SPECIMENS EXAMINED: One male and one female from Germany and Switzerland and three females from Alaska.

The female specimen from Switzerland has three intra-alar bristles on one side and four dorsocentrals on the other. This is probably abnormal, since the specimens from Alaska, which agree with it in all important respects, do not show this abnormal bristling.

It appears to be most closely related to *Xenomydaea nudiseta* Stein, but may readily be distinguished from that species by the entirely black legs, the less strongly retreating oral margin, the more strongly yellowed wing bases, and the equally well-developed bristles on the ventral surface of hind femora.

Xenomydaea nudiseta (Stein)

Mydaea nudiseta STEIN, 1920, Arch. Naturgesch., sect. A, vol. 83, p. 33.

MALE: Length 8.5 mm. Similar to *rufinervis* Pokorny. Parafacials, parafrontals, and cheeks silvery gray pruinescent. Front as in *buccata*. Juncture of parafacials and parafrontals four-fifths as long as third antennal segment, parafacials at narrowest slightly wider than greatest width of third antennal segment. Cheeks at greatest height one-third of head height or four times as high as width of third antennal segment, the lower margin distinctly retreating. Lower margin of cheeks as in *buccata*. Eyes bare. Antennae and palpi black. Arista bare. Third antennal segment scarcely longer than second.

Thorax black, densely grayish pruinescent, distinctly quadrivittate. Bristled as in *buccata*, except sternopleurals 1:2 and the dorsocentrals usually 2:3. Wings as in *rufinervis*.

Legs black, only hind tibiae with a very limited area on the knees reddish. Fore femora normal. Fore tibiae with one or two median posterior bristles. Mid femora bristled as in *buccata*. Mid tibiae with two or three median posterior bristles and a weaker median ventral bristle. Hind femora with a complete row of anteroventral bristles and a partial row of posteroventral ones on basal two-thirds. Hind tibiae with two median anterodorsal and three median anteroventral bristles.

Abdomen black, grayish to brownish gray pruinescent, marked as in *buccata*, but with more distinct dorsal and lateral checkerings. Bristled as in *buccata*.

SPECIMENS EXAMINED: Three males from Washington and Idaho including a cotype in the United States National Museum.

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NOTES AND DESCRIPTIONS OF SOME PHAONIINAE (DIPTERA, MUSCIDAE)

BY FRED M. SNYDER

Since publication of a partial revision of the *Mydaea* of the Neotropical region (Snyder, 1941), several additional species have been collected or have come to hand. A revised key to the genus is therefore included to facilitate identification of these species.

KEY TO NEOTROPICAL *Mydaea* ROBINEAU-DESVOIDY, SENSU STRICTO

1. Dorsocentral bristles 2 : 3 2
Dorsocentral bristles 2 : 4 4
2. Fore tibiae without a median posterior bristle; margins of calyptrae darkened .... *nubivena* Snyder
Fore tibiae with a median posterior bristle; margins of calyptrae not darkened 3
3. Palpi and at least the second antennal segment yellow .... *merida* Snyder
Palpi and antennae entirely black .... *cresa*, new species
4. With a dark costal cloud; fore tibiae with a median posterior bristle .... *fumicosta* Snyder
Without a dark costal cloud; fore tibiae without a median posterior bristle. 5
5. Margins of upper calyptrae infuscated; cross veins with narrow infuscated clouds .... *plaumanni* Snyder
Margins of upper calyptrae and cross veins not infuscated 6
6. At narrowest part of front, the frontal vitta three to four times as wide as parafrontal .... *caras*, new species
At narrowest part of front, the frontal vitta only as wide as width of parafrontal .... *compressicornis*, new species

Mydaea cresa, new species

FEMALE: Length 5.5 mm. Head black, grayish pruinescent. Frontal vitta velvety black, with a subshiny stripe which is sparsely pruinescent and extends three-fourths the distance to base of antennae. Front at vertex two-sevenths of head width and widened to five-fourteenths anteriorly. Parafrontals narrow, with a row of bristles, the anterior four to five pairs inwardly and the posterior two pairs outwardly directed. There are several short setulae laterad to the row of parafrontal bristles. Ocellar, inner, and outer vertical bristles strong. Juncture of parafacials and parafrontals as long as width of third antennal segment, parafacials narrowed to one-half this width below. Cheeks twice as high as width of third antennal segment and with about eight well-developed bristles along lower margin. Palpi and antennae black Antennae inserted opposite, and extending to slightly below lower edge of, eyes; third segment twice as long as second. Longest aristal hairs as long as greatest aristal diameter. Eyes with a few, very short, and widely scattered hairs.

Thorax black, bluish gray pruinescent; indistinctly quadrivittate. The median two vittae are narrowest but are most distinct. Acrostical setulae in five to seven irregular rows; acrosticals 0:1; dorsocentrals 2:3; pra minute or absent; with a few setulae adjacent to the posterior notopleural bristle; scutellar setulae not descending below level of marginal bristles. Sternopleurals 1:2; hypopleura entirely bare.

Legs black, except the basal one-third of hind femora and all tibiae which are fulvous, the base of the tibiae slightly darker. Fore femora normal. Fore tibiae with a median posterior bristle. Mid femora with three to five strong ventral bristles and with a weaker apical anterior one. Mid tibiae with two median posterior bristles. Hind femora with a complete row of strong anteroventral bristles and a row of shorter and weaker posteroventral bristles on basal half. Hind tibiae with two anterodorsal and one anteroventral median bristles.

Wings yellowish hyaline, darker at base and with a slightly darker area in the subcostal cell beyond the auxiliary vein. Anterior cross vein with a very faint cloud. Costal thorns and setulae scarcely developed. Third and fourth veins slightly divergent apically, posterior cross vein slightly curved. Calyptrae white, the ventral one with a narrow yellow margin. Halteres fulvous.

Abdomen black, bluish gray pruinescent; with distinct dorsal and lateral checkerings. Second tergite with apical lateral bristles; third with a complete row of strong marginals and three

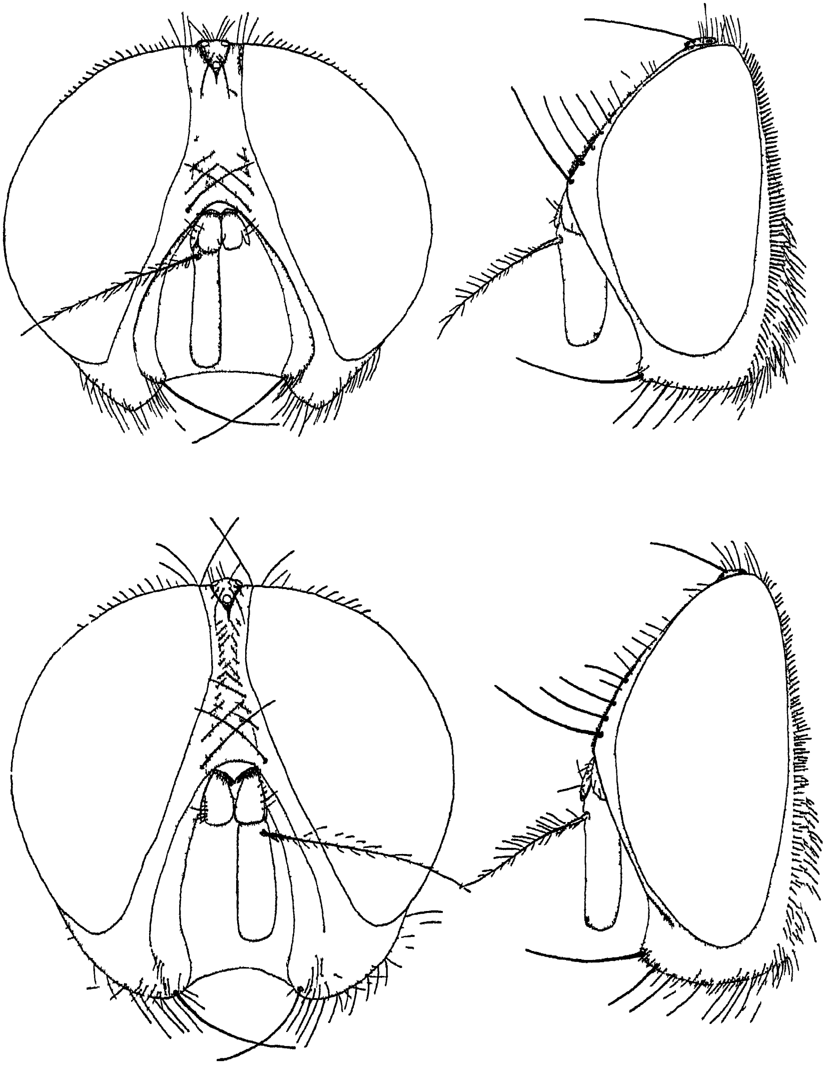


FIG 1 *Mydaea caras*, new species, front view, head of male
FIG 2 *Mydaea compressicornis* new species, front view, head of male
FIG 3 *Mydaea caras* new species side view, head of male
FIG 4 *Mydaea compressicornis*, new species, side view, head of male

or four weaker lateral discals. Fourth with a complete row of apical and discal bristles. Basal sternite bare. Suranal plate of ovipositer with thorns.

HOLOTYPE: Female, Cuernavaca, Mexico, 9800 feet elevation, August 15, 1943 (F. M. Snyder).

Mydaea compressicornis, new species

MALE: Length 6.0 mm. Head black, silvery gray pruinescent, the pruinescence on the frontal vitta more sparse. Palpi fulvous. Antennae fulvous brown, except at base of the third segment where it is more fulvous. Otherwise the head as in figures 2 and 4.

Thorax black, light bluish gray pruinescent; indistinctly quadrivittate and with a dark median vitta extending from disc of scutellum to opposite the second or third postsutural dorsocentral bristle. Acrostical setulae in about 14 irregular rows. Acrosticals 0:1; dorsocentrals 2:4; pra short, about one-fourth to one-third as long as the posterior notopleural bristle. Notopleura with a few setulae adjacent to the posterior bristle. Scutellar setulae descending to, but not below, level of marginal bristles. Sternopleurals 1:2; hypopleura with a few short setulae on the subtriangular portion above hind coxae.

Legs blackish brown, the knees fulvous and the tibiae, particularly on the basal half, more fulvous brown. Fore femora normal. Fore tibiae without median bristles. Mid femora with about four ventral bristles on basal half between which are interspersed finer setulae, the apical bristles on the anterior surfaces scarcely developed. Mid tibiae with two median posterior bristles. Hind femora with a row of anteroventral bristles; those at base shorter and more slender than the apical ones; with a row of posteroventral bristles on basal half. Hind tibiae with two median anterodorsal and one anteroventral bristles.

Wings hyaline; costal thorns and setulae minute. Third and fourth wing veins slightly divergent apically. Posterior cross vein nearly straight. Calyptrae white, halteres yellow.

Abdomen black, bluish gray pruinescent with dorsal and lateral checkerings. Tergites bristled as in *cresa*. Basal sternite bare, others except fifth with a pair of apical bristles.

FEMALE: Length 6 mm. Similar to the male. Head as in figure 5. Legs darker. Pulvilli and claws smaller. Apex of fourth visible abdominal tergite fulvous. Tergal bristles shorter and more slender.

TYPE MATERIAL: Holotype, male; allotype, female; paratype, one female; all from Medellín, Colombia, 4500 feet elevation, September 5, 1943 (F. M. Snyder).

Mydaea caras, new species

MALE: Length 5 mm. This species is so very similar to *compressicornis*, new species, that it may be distinguished from it only by the shape of the head, as illustrated in figures 1 and 3. *Caras* is slightly smaller, and the antennae are darker.

TYPE MATERIAL: Holotype, male, Caracas, Venezuela, September 25, 1943 (F. M. Snyder); paratype, one male, same data as holotype.

Mydaea plaumanni Snyder

Mydaea plaumanni SNYDER, 1941, Amer. Mus. Novitates, no. 1134, p. 3.

Descriptive notes of the male of this species are presented, since the original description was based upon a female.

MALE: Length 6.5 mm. Similar to the female, differs from it in the following respects: Front at narrowest part between eight- and nine-tenths of head width; the frontal vitta at this point as wide as each parafrontal. The stronger parafrontal bristles extend to the narrowest part of front and with one to three short setulae extending to anterior ocellus. Ocellar bristles stronger than the most robust parafrontal bristles.

The leg bristles are somewhat stronger and those of the femora are less hair-like.

Additional material seen from Villarica, Paraguay, July, 1937 (F. Schade), and Cuernavaca, Mexico, 5000 feet, August 15, 1943 (F. M. Snyder).

The metasternal hairs are absent in the above specimens. The species appears to be most closely related to *compressicornis*, new species, and may be distinguished from it by the infuscated base of palpi and the stronger ventral bristles on the mid femora in addition to the characters mentioned in the key.

Mydaea meridia Snyder

Mydaea meridia SNYDER, 1941, Amer. Mus. Novitates, no. 1134, p. 3.

A single teneral male specimen which is tentatively identified as this species agrees with the female except as follows: The front is quite broad but bristled as in the female. Antennae entirely fulvous. The thorax is less distinctly vittate, and the humeri are concolorous with the disc.

Fore tibiae with a single median posterior bristle. Abdomen with the first, second, and the lateral basal areas of the third visible tergites yellow, rest of tergites infuscated except for a narrow, brown, apical band on the first tergite and a broader one on second tergite which, at the mid-line, joins a broad triangular central spot which extends anteriorly almost the entire length of the tergite.

SPECIMENS EXAMINED: One male, Mexico City, Mexico, 9000 feet, August 15, 1943 (F. M. Snyder).

Helina arroya, new species

MALE: Length 7.5 mm. Head black, silvery gray pruinescent except for a velvety black frontal vitta. Narrowest part of front one-ninth of head width, or as wide as distance across posterior ocelli inclusive. At the same level, the parafrontals slightly narrower than diameter of anterior ocellus, and the frontal vitta two and one-half times as wide as parafrontal. The parafrontals with a row of moderately long and well-developed inwardly directed bristles which extend to the narrowest part of front. Ocellar bristles strong, slightly more well developed than the anterior parafrontal bristles. Ocellar setulae half as long and strong as ocellar bristles. Juncture of parafacials and parafrontals twice as long as width of third antennal segment, the parafacials scarcely narrowed below. Cheeks three times as high as width of third antennal segment and with one or two short, forwardly and upwardly directed setulae in the middle of the row of bristles along their lower margin. Bristles adjacent vibrissae numerous and well developed. Palpi and antennae black. Third antennal segment twice as long as second. Aristal hairs two-thirds as long as width of third antennal segment and about twice as long as greatest aristal diameter. Antennae inserted opposite middle of eyes and extending to below their lower margin. Eyes bare.

Thorax black, grayish pruinescent except on posterior portion of dorsum and on scutellum where it is brownish; distinctly quadrivittate, the thoracic bristles and clothing setulae long and slender. Acrostical setulae in three or four irregular rows. Acrosticals 0:1; dorsocentrals 2:3, with one or two long setulae interspersed between the postsutural ones; pra absent, no setulae adjacent either notopleural bristle. Sternopleurals 2:2. Hypopleura and prosternum bare; scutellum with setulae extending only to the level of marginals.

Legs black, articulation of tibiae and femora and a variable apical portion of hind tibiae reddish brown. Fore femora normal. Fore tibiae with a median posterior bristle. Mid femora with three or four long ventral bristles on basal half and a row of shorter anterior ones; apical bristles absent on anterior surfaces. Mid tibiae with two or three median posterior bristles. Hind femora with a complete row of strong, anteroventral bristles. Hind tibiae with three anterodorsal bristles, two strong ones at the middle and a weaker one on basal third; two median anteroventral bristles and a weak but distinct posterodorsal one on basal one-third and with five to seven median posterior setulae. Fore tarsus long and slender. Pulvilli and claws on all legs well developed.

Wings fulvous hyaline at base and along the longitudinal veins, but nowhere infuscated. Costal thorn and setulae scarcely developed. Third and fourth veins slightly divergent apically; posterior cross vein scarcely curved. Veins bare. Calyptrae yellowish white. Halteres fulvous.

Abdomen slightly elongated, black, yellowish gray pruinescent, with a pair of round brownish spots on second visible segment and a pair of smaller subconfluent ones on first segment. Clothing setulae on all segments long. Basal sternite with a few setulae. Others longer than broad and with long setulae. Fifth sternite deeply cleft, without distinctive armature.

FEMALE: Length 6.5 mm. Pruinescence of head more yellowish gray than in the male. Front at vertex three-sevenths of head width, widened to one-half anteriorly. The parafrontal bristles extending the entire length of front, the posterior two pairs outwardly directed. The ocellar setulae are short, but the inner and outer verticals are as well developed as the ocellar bristles. Bristles adjacent vibrissae sparse and less well developed than in the male.

Thorax with the vittae distinctly brownish and with a median vitta extending from scutellum to opposite level of anterior intra-alar bristle. Bristled as in the male, but clothing setulae very short.

Legs black, the lighter colored area near articulation of femora and tibiae more extensive ventrally; all tibiae light reddish brown on apical portions. Bristled as in male but the bristles shorter and the hind tibiae have two or three posterodorsal bristles and are without posterior setulae.

Costal thorns well developed. Otherwise wings as in the male.

Abdomen with paired brown central spots on second and third visible segments and with a median dorsocentral vitta on second, third, and fourth segments. The larger bristles inserted in round brown spots. The bristles and clothing setulae much shorter than in the male.

TYPE MATERIAL: Holotype, male; allotype, female; paratypes, six males and two females; all Mexico City, Mexico, 9000 feet, August 15, 1943 (F. M. Snyder).

The above description is based upon the holotype and allotype. The paratypes exhibit all of the essential characters; however, there is a variation in the extent of the light color of the hind tibiae and towards apex of the mid tibiae in the males. Some of the interspersed setulae in the dorsocentral rows are so bristle-like in certain specimens that the dorsocentrals might be considered to be 2:4 or 2:5.

The males will key out best to *lasiosterna* Snyder in the previously presented key to Neotropical *Helina* (Snyder, 1941, p. 5) and may be separated from that species by the shape of abdominal sternites and entirely darkened tarsi. If the dorsocentrals are assumed to be 2:4, the male runs to couplet 14 or *copiosa* Van der Wulp. It may be separated from those species in couplet 14 by the lack of presutural acrostical bristles and may be separated from *copiosa* by not having infuscated cross veins. The female will run out to the sixth couplet and may be separated from *copiosa* by the absence of the pra and from *caneo* Snyder by the more extensively infuscated femora and the absence of dorsal spots on first abdominal tergite.

Helina copiosa (Van der Wulp)

This species was included by error in that portion of a key to *Helina* (Snyder, 1941, p. 6) containing species with three postsutural dorsocentral bristles. The species should be considered to have four pairs of postsutural dorsocentral bristles. It will then run to couplet 22 and may be separated from *bifimbriata* Malloch by the absence of long, fine, posteroventral bristles on the hind femora.

AIRALIPS, NEW GENUS

Related to the *Helina lucorum* group, *Mulfordia* Malloch, and *Ariciella* Malloch.

This genus is separated from its relatives by the presence of fine hairs on the dorsal portion of the pteropleura, slender black setulae along the posterior margin of the metathoracic spiracle among the flap-like covering of hairs, setulae on the ventral surface of the third wing vein beyond the node, and hairs on the hypopleura below the spiracle.

It may be separated from *Mulfordia* by the absence of hairs on the dorsal apical margins of the hind coxae and by having the fourth wing vein not curved forward at apex. It differs from *Ariciella* by lacking the bristle-like setulae on the hypopleura in front of the spiracle and by the absence of setulae on the postalar declivity.

GENOTYPE: *Spilagaster plumata* (Stein).

KEY TO SPECIES

1. Scutellar setulae descending onto ventral surface of scutellum; with two equally long and strong stigmatal bristles 2
   Scutellar setulae not invading ventral surface of scutellum; with a single stigmatal bristle on each side or with a strong and a very much weaker one..3
2. Antennae, palpi, and a portion of scutellum fulvous.......*plumata* (Stein)
   Antennae, palpi, and entire scutellum infuscated.....*caerulea,* new species
3. Dorsocentrals 2:3..........................*fuscomarginata,* new species
   Dorsocentrals 1:3.............................*differentia,* new species

Airalips plumata (Stein)

Spilogaster plumata STEIN, 1904, Ann. Hist. Nat. Mus. Natl. Hungarici, vol. 2, p. 446; SNYDER, 1940, Amer. Mus. Novitates, no. 1060, p. 9.

Front of male at narrowest part one and one-half times as wide as distance across posterior ocelli inclusive. Parafrontals contiguous for about one-third of their length, silvery gray pruinescent and with three to five pairs of bristles which extend posteriorly only to the point where parafrontals become contiguous. Anterior ocellar bristles three-fourths as long as vibrissae. Eyes less hairy than in the female.

Humeri and scutellum slightly fulvous. Dorsocentrals 2:3; intra-alars 2; pra short but distinct in female, usually absent in male; humerals 2; a few hairs on notopleura adjacent to the anterior bristle; mesopleura with a bristle below the anterior notopleural bristle; stigmatals strongly duplicated; scutellar setulae descending onto ventral surface. Posterolateral angles of prosternum, hypopleura below spiracle, pteropleura below base of calyptrae, and the area of the metapleura below the insertion of lower calyptrae with fine hairs or setulae.

Fore tibiae with a short, median, anterodorsal bristle which is usually stronger in the females. Mid femora with two to four anteroventral bristles on basal half, a row of short, anterior setulae on basal half and with an apical anterodorsal, dorsal, posterodorsal, and posterior bristle, the latter longest and strongest. Hind femora with two to five anteroventral bristles on apical one-third to one-half; males sometimes with a few very short median posterior setulae which are only slightly longer than the clothing setulae.

Apical abdominal tergite with a row of strong discal and apical bristles in males. Male hypopygium fulvous.

SPECIMENS EXAMINED: Ten males and 24 females, from Villarica, Paraguay, July, September, and December (F. Schade); Chapada, Brazil, November and December; Rio de Janeiro, Brazil, July; and Natal, Brazil, February and May (F. M. Snyder).

In all specimens except one male and one female from Villarica there are hairs on the prosternum and on the metapleura below the base of the lower calyptrae.

The specimens from Chapada and Rio de Janeiro, Brazil, are part of the S. W. Williston collection in the American Museum of Natural History.

Airalips differentia, new species

FEMALE: Length 7.0 mm. Head black with grayish pruinescence. Cheeks and frontal vitta more velvety and with reddish reflections. Front at vertex about one-fifth of greatest head width, widened to one-third anteriorly. Juncture of parafacials and parafrontals as long as width of third antennal segment, the parafacials reduced to a distance equal to greatest diameter of arista below. Cheeks one and one-half times as high as width of third antennal segment and with a row of three or four short, widely spaced bristles along ventral margin which are only one-third as long and strong as vibrissae. Parafrontals with a single pair of strong anterior, inwardly directed bristles which are as strong as the anterior ocellar bristles and the inner vertical bristles, all of which are about as long as length of front. Outer verticals, postocellars, and two pairs of outwardly directed, posterior, parafrontal bristles short, only half as long as the front. Antennae brown, the root of third segment and arista slightly fulvous. Antennae inserted opposite middle of eyes. Third segment comparatively narrow, about three and one-half times as long as second. Longest hairs on arista about half as long as length of third antennal segment. Palpi slender, black, and with numerous fine bristles. Proboscis brownish, with grayish pruinescence. Eyes with short, widely scattered, fine hairs.

Thorax black, grayish blue pruinescent, and with four very narrow black vittae. With a very short pair of fine, prescutellar, acrostical, setulose bristles. Presutural acrostical setulae in 10 to 12 rows; dorsocentrals 2:3; intra-alars 2; humerals 1; pra one-half as long as the posterior notopleural bristle; notopleura with a few setulae adjacent to the anterior bristle. Sternopleurals 1:2; prosternum, and hypopleura below spiracle, with a few fine hairs. Scutellar setulae descending slightly below level of marginals but not onto ventral surface.

Legs orange brown, the tarsi almost black. Fore femora normal. Fore tibiae with a median anterodorsal bristle on basal one-third. Mid femora with a single short, ventral bristle on basal one-fourth, two or three scarcely differentiated anterior bristles at middle, and with a strong apical, anterodorsal, dorsal, posterodorsal, and posterior bristle, the latter strongest. Mid tibiae with two posterior bristles on basal one-half. Hind femora with a single strong, anteroventral bristle on apical one-fifth, other surfaces except anterodorsal without bristles. Hind tibiae with one median anterodorsal and two anteroventral bristles; the basal setulae of a series of short, scarcely discernible posterodorsal setulae on apical one-third slightly more developed, so there appears to be a very weak calcar which is not so long as diameter of tibiae where situated.

Wings hyaline, but slightly brownish yellow along costal margin and adjacent to the posterior cross vein. Costal thorns and setulae scarcely developed. Several setulae beyond node on ventral surface of third wing vein. Third and fourth wing veins divergent at apices. Posterior cross vein distinctly curved. Calyptrae white, with a narrow brown margin, halteres yellowish, the knobs dark brown.

Abdomen bluish black, bluish gray pruinescent. Apex of fourth visible tergite slightly brownish, with an indistinct dorsocentral vitta along middle of abdominal tergites. First and second abdominal segments with one or two apical lateral bristles. Third with three or four apicals and fourth with two basals. Basal sternite bare, others with a few short apical bristles. Suranal plate without thorns.

HOLOTYPE: Female, Rio Charape, Peru, September 13 (C. H. T. Townsend), United States National Museum.

Airalips fuscomarginata, new species

FEMALE: Length 6.5 mm. Quite similar to *differentia*, the antennae darker and only the arista brownish. Juncture of parafacials and parafrontals about three-fourths as long as width of third antennal segment and the bristles along ventral margin of cheeks shorter, more numerous, and closely placed.

Dorsocentrals 2:3, the anterior presutural pair one-half as long as the stronger and more well-developed posterior presutural pair. With a single stigmatal bristle on each side.

Legs lighter, especially apical portion of femora. Mid femora with three or four ventral bristles on basal three-fourths, the basal two strongest and about as long as diameter of femora. No conspicuous weak posterodorsal setula on hind tibiae.

Wings entirely hyaline and posterior cross vein not so distinctly curved. Halteres darker and the dark margins of the calyptrae slightly more conspicuous.

Third abdominal tergite with a row of six apical bristles.

HOLOTYPE: Female, Cali District, western Cordillera, Colombia, January 26, 1935 (Severo Quintero).

Airalips caerulea, new species

FEMALE: Length 8.5 mm. Head black, silvery gray pruinescent, the frontal vitta dark, the frontal triangle narrowly extending to the base of the antennae. Front at vertex one-fourth of greatest head width, broadened to slightly more than one-third at widest part. Juncture of parafacials and parafrontals as long as width of third antennal segment, narrowed to about diameter of arista below. Cheeks one and one-half times as high as width of third antennal segment. With four pairs of parafrontal bristles, the posterior three pairs about one-third to one-half as strong as anterior pair, the anterior two pairs inwardly, the posterior two pairs outwardly, directed. Parafrontals with numerous fine hairs between the bristles. The vibrissae, anterior parafrontal, anterior ocellar, and inner vertical bristles equally developed, the posterior three pairs of parafrontal bristles and outer verticals short, about one-half as long as the other bristles. Palpi black, longer than apical chitinized portion of proboscis, the latter equal in length to third antennal segment. Antennae inserted opposite center of eye, the base of third segment and arista obscurely brownish. Arista long plumose, the longest hairs about three times as long as width of third antennal segment, third antennal segment two and nine-tenths times as long as second. Eyes with a few scattered short hairs.

Thorax black, bluish gray pruinescent, with four very narrow shiny black vittae. Acrosticals 0:1; dorsocentrals 2:3; intra-alars 2; humerals 2; pra very short but distinct; notopleura with setulae at base of anterior bristle; two strong and one weak pair of scutellar bristles; scutellar setulae descending onto ventral surface; prosternum and propleura bare. Sternopleurals 1:2; pteropleura near base of wings and hypopleura below spiracle and above hind coxae with hairs. Stigmatal bristle strongly duplicated. With a short but distinct bristle on mesopleura opposite anterior notopleural bristle.

Legs fulvous, tarsi and streaks on coxae black. Fore and mid coxal bristles very long and strong. Fore femora normal. Fore tibiae with one median anterodorsal bristle. Mid femora with two ventral bristles on basal one-third, an apical anterior, dorsal, posterodorsal, and posterior bristle. Mid tibiae with two strong and one weak posterior bristles. Hind femora with a single strong, subapical, anteroventral bristle. Hind tibiae with one median anterodorsal and two anteroventral bristles.

Wings hyaline, costal thorns and setulae weak; third and fourth veins divergent apically; third vein with two or more setulae on ventral surface beyond the node. Posterior cross vein slightly curved. Calyptrae hyaline, margins slightly yellow; halteres brownish orange.

Abdomen black, bluish gray pruinescent, with dorsal and lateral checkerings. First abdominal tergite with a single lateral discal and marginal bristle; second with a single lateral subapical; third with a row of apicals and fourth with a row of discals and a row of weaker apicals. Basal sternite bare; others with a single pair of strong apicals.

HOLOTYPE: Female, Caracas, Venezuela, 3000 feet, September 25, 1943 (F. M. Snyder).

PSEUDOPTILOLEPIS, NEW GENUS

This genus may be distinguished by the following combinations of characters: pteropleura, postalar declivity, hypopleura in front of spiracle, and lateral margins of posterior portion of prosternum setulose. Posterior thoracic spiracle with several strong setulae in lower margin in addition to the flap-like covering of hairs. Hind coxae with a row of short setulae along the dorsal apical margin (fig. 7). Stem vein with several long, fine setulae at base on dorsal and ventral surfaces and another group opposite humeral cross vein on ventral surface (fig. 6). Node and third vein setulose on both surfaces, those on dorsal surface extending to beyond anterior cross vein, and those on ventral surface extending only to the cross vein. Fourth wing vein, strongly curved forward, ending slightly behind wing tip; curvature of fourth vein evenly rounded. Lower calyptrae with fine, upstanding setulae on dorsal apical one-fourth to one-third of disc. The calcar is absent on the hind tibiae.

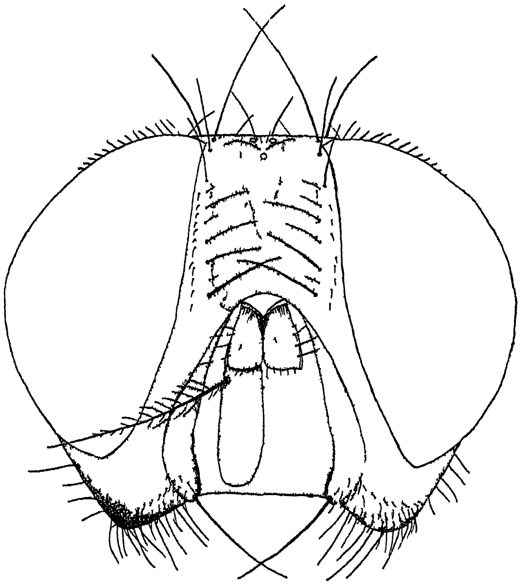
GENOTYPE: *Pseudoptilolepis fulvapoda*, new species.

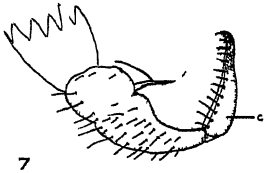
The most distinguishing features of this genus are the squamal and hind coxal hairs. It appears most closely allied to *Chaetogenia* Malloch (1929, p. 308) but may be distinguished from that genus by the absence of hairs on the fifth wing vein and by the presence of hairs on disc of lower calyptrae. *Ptilolepis* Bezzi, the only other muscid genus known to me possessing the squamal setulae, is a true member of the Muscinae and is readily separated from the present genus by the truncate lower calyptrae and angular bend of the fourth wing vein.

Mydaea latipalpis Stein (1918, p. 216) may belong to this genus, but an examination of the type should be made before including it. It may be distinguished from the three species included by the four pairs of postsutural dorsocentral bristles.

KEY TO SPECIES

1. Propleura with fine yellow hairs in center........... *fulvapoda*, new species
   Propleura entirely bare.. 2
2. Hind femora at least, and margins of lower calyptrae infuscated........... .... *nigripoda*, new species
   All femora and margins of lower calyptrae not infuscated.............. 3
3. Apical anterodorsal and apical dorsal bristle on fore tibiae subequal, as long as diameter of tibiae....................... *nudapleura*, new species
   Apical anterodorsal bristle absent or, if setulose, not so long as the dorsal bristle or diameter of tibiae.................... *confusa*, new species





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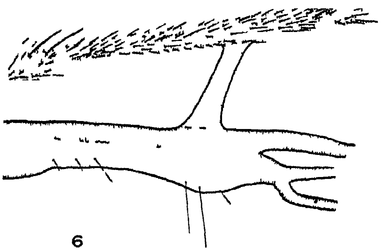

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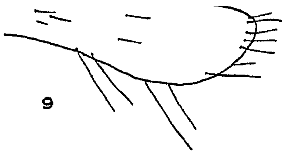

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FIG. 5. *Mydaea compressicornis*, new species, front view, head of female.
FIG. 6. *Pseudoptilolepis fulvapoda*, new species, ventral surface, stem vein.
FIG. 7. *Pseudoptilolepis nigripoda*, new species, left hind coxa (c) and trochanter.
FIG. 8. *Pseudoptilolepis fulvapoda*, new species, palpus of female.
FIG. 9. *Pseudoptilolepis nigripoda*, new species, palpus of female.

Pseudoptilolepis fulvapoda, new species

MALE: Length 5 to 7 mm. Head yellow, the dorsal half of occiput infuscated. Parafrontals linear, contiguous for almost their entire length so that the frontal vitta is reduced to a mere triangular spot above base of antennae. Parafrontals with a complete row of bristles, those on anterior half longer and stronger and directed inward or backward, while the posterior ones, except the last pair, are fine and directed forward; the posterior pair outwardly directed, strong, and about as long as the ocellar bristles. Eyes separated by a distance equal to the diameter of the anterior ocellus. Juncture of parafacials and parafrontals not protruding, scarcely as long as greatest diameter of arista, the parafacials slightly narrower below. Cheeks narrow, three-fourths as high as width of third antennal segment, and with a single upwardly directed black bristle in addition to the usual row on the ventral margin. Facial ridges with short, fine, pale setulae which extend upward to opposite the middle of third antennal segment. Antennae yellow; third segment three times as long as second. Longest aristal hairs slightly longer than the greatest width of third antennal segment. Beard yellow, other setulae and hairs on head black. Palpi yellow, not conspicuously dilated (fig. 8). Eyes bare.

Thorax yellow, with an obscurely brownish pair of presutural vittae, which extend posteriorly to about middle of postsutural disc. With distinct gray pruinosity on the presutural portion between the vittae; less distinctly pruinose laterally. Acrosticals 0:1; the presutural acrostical setulae in about 10 irregular rows and with two or three presutural setulae slightly more well developed than the others. Dorsocentrals 2:3; intra-alars 1; pra short but distinct, about one-half as long as the posterior notopleural bristle; notopleura not setulose. Scutellum with a pair of strong basal and apical bristles, and a weaker pair of subbasal and subapical ones. Scutellar setulae descending onto ventral surface. Sternopleurals 1:2; a single strong stigmatal bristle on each side; mesopleura with a weak but distinct bristle opposite anterior notopleural bristle.

Legs entirely yellow. Fore femora normal. Fore tibiae with a median posterior to posteroventral bristle. Fore metatarsus with a clump of short, basal, ventral setulae from which apparently arises a single long, fine, black hair and with a pair of similar long, fine, apical ventral hairs on it and other tarsal segments. Pulvilli and claws short. Mid femora with a row of fine ventral setulae on basal half and with one or two apical posterior and posterodorsal bristles. Mid tibiae with four or five posterior bristles and a single median posteroventral bristle. Hind femora with a complete row of fine, anteroventral and posteroventral bristles, the former longest apically and the latter longest basally. Hind tibiae with two median anterodorsal and anteroventral bristles, the apical anteroventral thorn-like bristle slightly curved.

Wings brownish hyaline; the anterior cross vein only with a very narrow, scarcely distinguishable, infuscated cloud. Calyptrae brownish hyaline, margins of both upper and lower ones distinctly darker, the marginal hairs pale, those on disc black. Halteres yellow.

Abdomen brownish yellow, the apical two segments bluish black, which are concolorous with an indistinct, median, darkened spot on the second visible tergite. Second and third tergites with distinct lateral apical bristles and the fourth with a complete row of discals and apicals. Basal sternite hairy. Fifth sternite with the cleft moderately excavated. Hypopygium black.

FEMALE: Length 6 mm. Similar to the male, differing in having the head at vertex slightly less than three-tenths of head width, parallel sided to base of antennae. Parafrontals with a pair of strong, subapical, and median bristles and with several less well-developed ones between; with a pair of short, outwardly directed, posterior, parafrontal bristles opposite ocellar triangle, and with several small setulae opposite the row of parafrontal bristles.

Hind femora without strong posteroventral bristles. The fifth abdominal segment without the row of strong apical bristles.

TYPE MATERIAL: Holotype, male, Nova Teutonia, Brazil, latitude 27° 11′ S., longitude 52° 23′ W., May 23, 1939 (Fritz Plaumann); allotype, female, topotypical, June 13, 1939; paratype, one male, topotypical, June 14, 1939.

Pseudoptilolepis nigripoda, new species

FEMALE: Length 5.5 mm. Head fulvous, dorsal half of occiput and ocellar triangle dark. Parafacials and parafrontals with sparse, silvery gray pruinescence. Front parallel sided at vertex, one-fourth of greatest head width. With a complete row of parafrontal bristles, the apical ones strongest and inwardly directed; posterior two pairs outwardly directed. Inner and outer vertical bristles well developed, subequal to the strong ocellars. Postocellars weak, one-half as long as ocellars. With a row of weak setulae laterad to the parafrontal bristles. Juncture of parafacials and parafrontals about three-fourths as long as width of third antennal segment; parafrontals scarcely distinguishable below. Cheeks about three-fourths as high as width of third antennal segment and with two upwardly directed black bristles in addition to the usual ventral row. Antennae yellow, inserted opposite middle of eyes. Third segment two times as long as second. Longest aristal hairs as long as width of third antennal segment. Palpi fulvous, broadly dilated (fig. 9). Eyes bare.

Thorax shiny bluish black, the humeral, postalar, and apical areas of scutellum fulvous. The darkened areas with whitish pruinescence. Bristled as in *fulvapoda* except none of the presutural acrostical setulae are well developed. Propleura bare.

Fore legs fulvous, mid and hind legs dark brown; all tarsi dark fulvous. Legs bristled as in *fulvapoda.*

Wings as in *fulvapoda.* The margins of both calyptrae dark brown, strongly differentiated from the lighter colored disc.

Abdomen bluish black, the basal segment, and a basal lateral area of second, yellow. Basal segment with a darkened apical margin. Fifth segment with a row of strong discal and a row of shorter apical bristles.

MALE: Length 6 mm. Similar to the female, differs in having the front linear, for most of its length no wider than diameter of anterior ocellus, the frontal vitta obscured except at base of antennae. With a complete row of parafrontal setulae, as in *fulvapoda.* Palpi not broadened at all, parallel sided.

Thorax and legs bristled as in *fulvapoda*, except the posteroventral bristles on hind femora shorter and finer.

Abdomen with all segments yellowish at base and with a dark, apical, transverse band.

TYPE MATERIAL: Holotype, female, Balboa, Panama Canal Zone, June 12, 1943 (F. M. Snyder); allotype, male, Barro Colorado Island, Canal Zone, October, 1942 (J. Zetek); United States National Museum. Additional localities, Blue Fields, Nicaragua, and El Ceremo, Panama, in fruit-fly traps.

Pseudoptilolepis nudapleura, new species

FEMALE: Length 6.5 mm. Very similar in structure to *nigripoda.* Head color more yellowish and the front slightly widened anteriorly. Cheeks with a single upwardly directed bristle. Palpi not quite so broadly dilated (fig. 10).

Thorax fulvous, with a narrow castaneous central stripe and with sparse, silvery gray pruinescence. Bristled as in *fulvapoda,* but, like *nigripoda,* it has no well-developed, presutural, acrostical, bristle-like setulae, and the propleura is bare.

Legs entirely fulvous. Bristled as in *fulvapoda,* except the hind femora has two or three moderately long, median, posteroventral bristles, and the apical anterodorsal and dorsal bristles on fore tibiae are subequal, longer than diameter of tibiae where situated.

Abdomen as in *nigripoda.*

HOLOTYPE: Female, Villarica, Paraguay, August, 1937 (F. Shade).

Pseudoptilolepis confusa, new species

FEMALE: Length 5.5 mm. Head yellow, ocellar triangle and upper half of occiput except area from neck to outer verticals dark brown. Front at vertex one-fourth of head width, only slightly widened anteriorly, otherwise as in *fulvapoda.* Palpi slightly broadened (fig. 11).

Thorax fulvous, with a rather conspicuous white pruinescent presutural spot in acrostical area. Bristled as in *fulvapoda,* except propleura is bare in center.

Wings hyaline, calyptrae white; halteres fulvous yellow.

Legs entirely fulvous, bristled as in *fulvapoda,* except metatarsal hair shorter and less distinct; posteroventral setulae on hind femora very short, scarcely developed. Hind tibiae with two anterodorsal and one or two anteroventral bristles.

Abdomen fulvous brown, with a transverse black apical band which is medianly dilated on second and third tergites. A strong row of discal bristles on apical tergite; basal sternite bare.

MALE: Length 6 mm. Head yellow, silvery pruinescent, only upper half of back of head brown. Front at narrowest part as wide as distance across posterior ocelli inclusive. Parafrontals contiguous along one-third their length. Parafrontal setulae anterior to posterior pair much reduced.

Thorax yellow with dense, silvery white pruinescence; presutural spot of female absent in the male. Bristled as in *fulvapoda*, but pra absent.

Legs as in *fulvapoda* male except bristles at middle of posteroventral surface of hind tibiae longest.

Wings hyaline; calyptrae yellowish white; halteres yellow.

Abdomen yellow, with an apical brown band on first to third tergites. That on first narrowest, that on third broadest, and with a trace of a very narrow median vitta.

TYPE MATERIAL: Holotype, female, and allotype, male, Quebrada, Secca, Venezuela, in United States National Museum.

ORAMYDAEA, NEW GENUS

Proboscis with mentum lanceolate, without labellae (fig. 12). Face strongly concave, facial ridges prominent, with several rows of short bristles. Arista plumose. Propleura, pteropleura, and prosternum bare; hypopleura with one or two setulae above hind coxae. Fourth wing vein slightly curved forward apically. Node with a single strong bristle on dorsal and ventral surface. Hind tibiae without calcar.

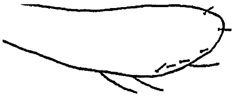
The deeply dished face, long third antennal segment, and hairy facial ridges are very similar to the Neotropical *Chadrella macrosoma* Van der Wulp. However, the peculiar mouth parts and non-truncate lower calyptrae will readily separate the two. It appears to be most closely allied to the Mydaeini and not the Stomoxydinae despite the peculiar mouth parts.

GENOTYPE: *Oramydaea latifrons*, new species.

Oramydaea latifrons, new species

MALE: Length 5.5 mm. Head black, silvery gray pruinescent, when viewed from behind the front velvety black; viewed from in front, with a grayish frontal triangle reaching to base of antennae. Eyes bare. Shaped and bristled as in figures 13 and 14.

Thorax black, grayish pruinescent, without vittae; scutellum with a subtrianglar, grayish pruinescent area at lateral angle so that the median portion of scutellar disc appears black. Pleura very sparsely pruinescent, viewed from behind appearing almost shiny. Acrosticals 0:1, very weak; dorsocentrals 2:4, the anterior postsutural pairs shorter; intra-alars 2; pra not differentiated. Scutellar setulae not descending below level of marginals, without setulae adjacent to the notopleural bristles.



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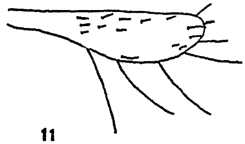

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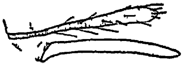

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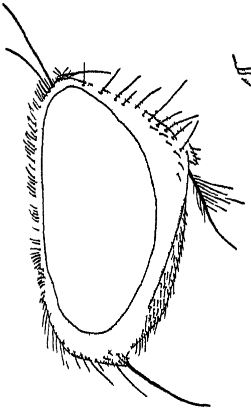

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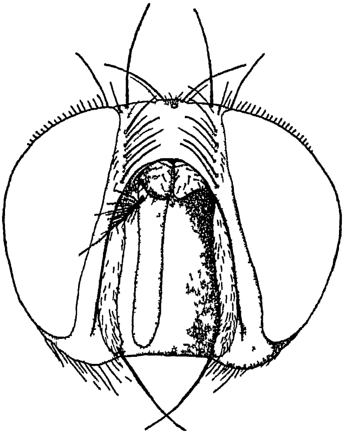

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FIG. 10 *Pseudoptilolepis nudapleura*, new species, palpus of female.
FIG. 11. *Pseudoptilolepis confusa*, new species, palpus of female.
FIG. 12. *Oramydaea latifrons*, new species, lateral view, proboscis of male.
FIG. 13. *Oramydaea latifrons*, new species, lateral view, head of male.
FIG. 14. *Oramydaea latifrons*, new species, front view, head of male.

Sternopleurals 1:2. Posterior spiracle very small, round; both spiracles with brownish black flaps and without setulae in flap-like covering of hairs.

Legs entirely black. Fore femora normal. Fore tibiae without median bristles. Mid femora with two median anterior, two or three ventral bristles on basal half and an apical posterodorsal and two apical posterior bristles. Mid tibiae with two median posterior bristles. Hind femora with three widely spaced anteroventral, and two posterodorsal, bristles on median one-third. Hind tibiae with three submedian anterodorsal and anteroventral bristles. Pulvilli and tarsal claws well developed.

Wings hyaline, slightly yellowish towards base. Costal thorn and setulae scarcely developed. Subcosta abruptly and strongly curved forward apically. Posterior cross vein strongly curved. Penultimate section of fourth vein five-ninths as long as ultimate. Fourth vein gently curved forward ending well behind wing tip. Calyptrae white, lower one not truncate, extending well beyond margin of upper. Halteres fulvous.

Abdomen black, bluish gray pruinescent. All tergites with a median black spot. Second tergite with a single lateral bristle; third with a row of eight apicals; fourth with six lateral discals and a row of apicals. Basal sternite with one or two setulae; others longer than broad, with a pair of well-developed apicals; fifth distinctly cleft, without distinctive armature.

HOLOTYPE: Male, Accra, Gold Coast, August 3, 1942 (F. M. Snyder).

DASYMORELLIA MALLOCH

Trichomorellia STEIN, 1919, Arch. Naturgesch., sect. A, vol. 83, p. 109.

Dasymorellia MALLOCH, 1923, Ann. Mag. Nat. Hist., ser. 9, vol. 12, p. 526.

Chlorellia SHANNON AND DEL PONTE, 1926, Rev. Inst. Bact., Buenos Aires, vol. 4, p. 567; 1928, *ibid.*, vol. 6, p. 142.

As noted by Shannon and Del Ponte, this genus belongs to the Phaoniinae because of the non-truncate lower calyptrae. It appears closely allied to the African *Pyrellina* Malloch, but is separated from that genus by the bare prosternum and absence of hypopleural hairs below the spiracle.

KEY TO NEOTROPICAL *Dasymorellia*

1. All femora entirely black; at least the lower calyptrae infuscated along the margin.......... 2
   All femora partly fulvous; margins of calyptrae not infuscated.......... ....*fulvitibia*, new species
2. Halteres pale; first wing vein setulose; abdomen not bluish; eyes bare; presutural acrosticals not strong...............*nigritibia*, new species
   Halteres black; first wing vein bare; abdomen iridescent blue; eyes with distinct hairs; presutural acrosticals strong..........*trichops* Malloch

Dasymorellia fulvitibia, new species

FEMALE: Length 7.5 mm. Head entirely black, grayish pruinescent, three-fifths as long as high. Front at vertex three-tenths of head width, slightly widened opposite the anterior, forwardly directed orbital bristle, then narrowed to width at vertex at base of antennae. Parafrontals as wide as distance across posterior ocelli inclusive. Juncture of parafacials and parafrontals three-fourths as long as width of third antennal segment; the parafacials narrowed to half this length below. Cheeks one and three-fourths times as high as width of third antennal segment. With 10 to 12 pairs of inwardly directed parafrontal bristles which extend from base of antennae to anterior ocellus, the posterior two are outwardly directed; with one very strong and one or two weaker forwardly directed bristles at dorsal third laterad to the cruciate row of parafrontals. Inner verticals strong, equal in strength to the strong, forwardly directed orbital bristle; outer verticals weaker, equal in strength to the anterior ocellars; posterior ocellars scarcely developed. Facial ridges with distinct setulae reaching to about opposite middle of third antennal segment. Antennae black; third segment two and one-fifth times as long as second. Antennae inserted opposite the middle of eyes and extending to almost opposite the lower level of eyes. Longest aristal hairs half as long as length of third antennal segment. Palpi black; proboscis grayish pruinescent. Eyes bare.

Thorax black in ground color, densely whitish gray pruinescent, and with four very narrow black vittae, the space between the median dorsocentral vittae with a dense white pruinescent spot and with a grayish spot at lateral margins of scutellum. Acrosticals 0:2, acrostical setulae in 10 to 14 irregular rows; dorsocentrals 2:4; intra-alars 2; pra strong, as long as posterior notopleural bristle; notopleura with numerous hairs adjacent to both the notopleural bristles. Scutellar setulae descending below level of marginals and invading ventral surface at base. Sternopleurals 1:2; propleura bare; pteropleura setulose; hypopleura bare in front of spiracle, bare below spiracle but with hairs above hind coxae; postalar declivity bare; infra-alar bulla bare; supraspiracular convexity with very short, black pile; posterior thoracic spiracle with numerous setulae among the black, flaplike covering of hairs along the posterior margin; prosternum bare.

Coxae, trochanters, tarsi, basal half of tibiae, and apical third of mid and hind femora, and an anterodorsal cloud on fore femora black, rest of legs fulvous. Fore femora normal. Fore tibiae with a row of very short anterodorsal setulae. Mid femora with two strong ventral bristles on basal half and with an apical anterodorsal and two posterior bristles; on apical third of posterior surface is a row of short, bristle-like setulae. Mid tibiae with four weak posterodorsal and three stronger posterior bristles. Hind femora with a row of strong anteroventral bristles on apical half and with several weaker ones on basal half; with a single, median, posteroventral bristle. Hind tibiae with two median anterodorsal and three to four anteroventral bristles, with a weak posterodorsal bristle near base on posteroventral surface in addition to calcar.

Wings hyaline; costal setulae and thorns undeveloped. Fourth vein strongly curved forward, ending at about the tip of wing. Posterior cross vein slightly curved. First vein hairy dorsally from beyond humeral cross vein to its apex and third vein hairy on both surfaces from node to apex. Calyptrae yellowish brown hyaline; halteres pale.

Abdomen bluish black, grayish pruinescent, with a narrow median dorsocentral vitta and with dorsal and lateral checkerings. Second and third visible tergites with two or three strong lateral apical bristles on each side and a complete row of discals and apicals on last tergite. Basal sternite setulose, others almost as broad as long and with a pair of strong apicals.

TYPE MATERIAL: Female, Guatemala City, Guatemala, 5000 feet elevation, August 20, 1943 (F. M. Snyder); paratype, one female, Cuernavaca, Mexico, 5000 feet elevation, August 15, 1943 (F. M. Snyder).

There are some slightly more well-developed presutural acrostical setulae which might almost be considered as acrostical bristles.

Dasymorellia nigritibia, new species

FEMALE: Length 8 mm. Similar to *fulvitibia*, differing in having the front not so distinctly widened at dorsal third. Cheeks slightly reddish black. Legs entirely black, only the articulation of tibiae and femora brownish. Hind femora with three or four apical anteroventral bristles and two median posteroventral bristles. Hind tibiae with two or three anterodorsal and three anteroventral bristles. Calyptrae margined with deep brown. Abdominal sternites distinctly longer than broad.

HOLOTYPE: Female, Medillín, Colombia, 4500 feet elevation, September 5, 1943 (F. M. Snyder).

Dasymorellia trichops Malloch

Trichomorellia cyanea STEIN (*nec* Macquart), 1918, Ann. Hist. Nat. Mus. Natl. Hungarici, vol. 16, p. 204; 1919, Arch. Naturgesch., sect. A, vol. 83, p. 109.

Dasymorellia trichops MALLOCH, 1923, Ann. Mag. Nat. Nist., ser. 9, vol. 12, p. 526.

Chlorellia aenula SHANNON AND DEL PONTE, 1926, Rev. Inst. Bact., Buenos Aires, vol. 4, pp. 567, 580; 1928, *ibid.*, vol. 6, p. 142.

This species is known from Argentina, Brazil, Peru, and Bolivia. There are several additional males and females before me from Baños, Ecuador, 1850 meters, December 26, 1938, and March 11, 1939 (F. M. Brown), and Medillín, Columbia, 4500 feet, September 6, 1943 (F. M. Snyder).

The true *cyanea* Macquart belongs to *Myospila*.

Unless otherwise stated, all holotypes recorded in this paper are, or will be, deposited in the American Museum of Natural History.

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NEW GENERA AND SPECIES OF LISPINAE (DIPTERA, MUSCIDAE)

By Fred M. Snyder

LISPE LATREILLE

Lispe Latreille, 1796, Précis des caractères génériques des insectes, p. 169.

This genus is quite poorly represented in the Neotropical region. Two apparently new species were collected at Natal, Brazil. They may be separated from related species by the following key.

Key to Neotropical *Lispe*

1. Mid tibiae with only a posterior median bristle........2
   Mid tibiae with a submedian anterior or anterodorsal bristle in addition to the posterior median bristle........4
2. Hind femora with a row of short, stout, posteroventral bristles on basal half........*setuligera* Stein
   Hind femora posteroventrally bare........3
3. Males with a prolongation of fore metatarsus........*tentaculata* DeGeer
   Males with a simple fore metatarsus........*vilis* Stein
4. The presutural dorsocentral bristles strong; the anterior one as strong as the outer vertical and the posterior one as long as the anterior ocellar bristle........5
   The presutural dorsocentral bristles weak, the anterior one, if present, never so strong as the outer vertical, and the posterior one smaller than the anterior ocellar bristle........*latana*, new species
5. Three pairs of postsutural dorsocentral bristles........6
   Four pairs of postsutural dorsocentral bristles, the anterior two pairs weak........*edwardsi* Malloch
6. The anterior postsutural dorsocentral bristle strong; second antennal segment with only a small fulvous spot at apex; with well-defined dark abdominal markings........*levis* Stein
   The anterior postsutural dorsocentral bristle very small, scarcely developed; second antennal segment entirely fulvous; posterior margins of abdominal tergites broadly fulvous and with ill-defined markings........*lisarba*, new species

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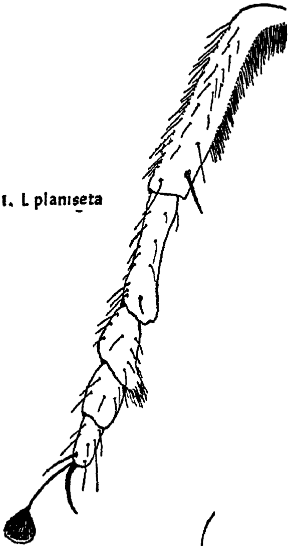

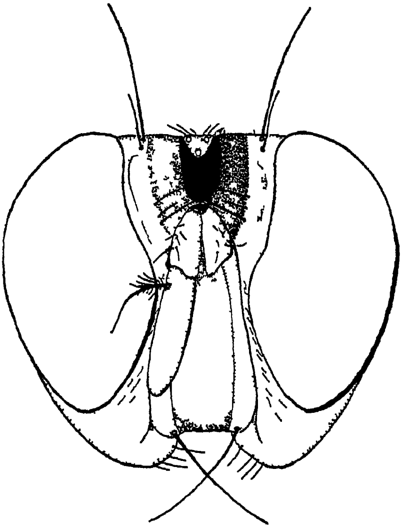

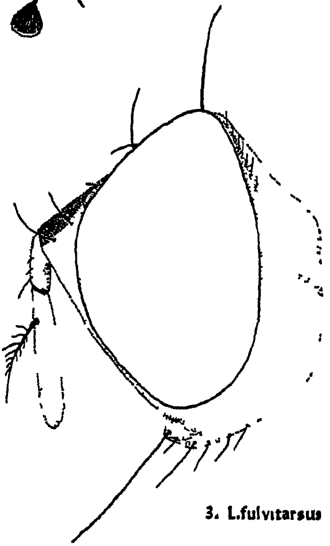

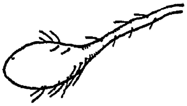

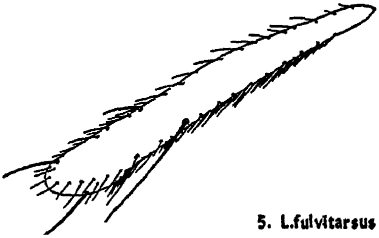

FIG. 1. *Lispe planiseta*, new species, front leg, tibia, and tarsus.
FIG. 2. *Lispacoenosia fulvitarsus*, new species, frontal view of head.
FIG. 3. Idem, lateral view of head of male.
FIG. 4. Idem, palpus.
FIG. 5. Idem, hind tibia.

Lispe lisarba, new species

MALE: Length 5 to 5.5 long. Head black; cheeks and lower half of occiput grayish pruinescent, face yellowish gray pruinescent; parafrontals, the upper part of occiput, and frontal vitta velvety black, with sparse whitish pruinescence. Front widest at middle, narrowed at apex and base of antennae. Parafacials with moderately coarse setulae. Second antennal segment fulvous; third brownish black, one and one-fourth to one and one-half times as long as second. Palpi light yellow, moderately dilated. Proboscis shiny brown.

Thorax black, dorsum with dense brown pruinescence, with only a trace of three very narrow, dark vittae, a median one and two lateral ones, through plane of the dorsocentral bristles; pleura with yellowish gray pruinescence. Acrosticals entirely absent; dorsocentrals 2:3, the anterior postsutural dorsocentral bristle greatly reduced, scarcely one-fifth as long as the bristle behind it. Scutellum with a pair of strong basals and apicals; sternopleurals 1:2. Hypopleura with several setulae above hind coxae.

Legs black, the knees, tibiae, and fore and mid metatarsi fulvous. Fore tibiae with a short, strong, median anterodorsal and a longer but more slender median posterior bristle. Fore tarsus as long as fore tibia, the apical tarsal segments slightly broadened. Mid femora with a median anterior, three or four anteroventral, and four to five posteroventral bristles on basal half, and an apical and subapical posterior bristle. Mid tibiae with a median anterodorsal and posterior bristle. Hind femora with three to four anteroventral and posteroventral bristles on basal one-half. Hind tibiae with a strong median anterodorsal and anteroventral bristle; basad of the anterodorsal bristle are two setulae and apicad there is one or no short setula.

Abdomen black, apices of tergites broadly fulvous, grayish pruinescent. Second to fourth visible tergites with a pair of very faint dark spots, the outlines of which are scarcely discernible.

Wings very faintly brownish hyaline. Third and fourth veins slightly convergent apically. Calyptrae white. Halteres yellow.

FEMALE: Length 5.5 mm. Very similar to the male. The posterior bristle on the fore tibiae is not so slender. Mid and hind femora without anteroventral and posteroventral bristles. The apical fore tarsal segments not broadened.

TYPE MATERIAL: Holotype, male; allotype, female; paratypes, seven males and one female; all from Natal, Brazil, February 5 to 24, 1943 (F. M. Snyder).

Lispe latana, new species

MALE: Length 5.5 to 6.5 mm. Similar to *lisarba,* the pruinescence on parafacials yellowish. Parafacial setulae slightly more coarse on lower one-half. Antennae black, only the apex of second antennal segment fulvous.

Thorax black, brownish gray pruinescent, with five well-defined brown vittae: one along mid line, one along the plane of each row of dorsocentral bristles, and one on each side along plane of sublateral and posthumeral bristles, this latter vitta almost confluent with a postsutural vitta along plane of intra-alar bristle. Acrostical bristles absent; dorsocentrals 2:4, the anterior presutural one very weak, the posterior one strongest but only as long as the outer vertical bristle; the anterior two postsutural dorsocentrals scarcely developed, not over one-eighth as long as third postsutural dorsocentral. Hypopleura above hind coxae bare or with only one or two hairs.

Legs black, only the extreme apices of femora and the tibiae fulvous, the latter with silvery gray pruinescence. Fore tibiae with the clothing setulae longer and more prominent than usual; with a median anterodorsal and posterior bristle, the latter longer but more slender and more apically situated. Apical fore tarsal segment slightly broadened; the fore tarsi as long as fore tibiae. Mid femora with a row of anteroventral and posteroventral bristles, the basal five or six in both series most distinct; a median anterior bristle, and with a subapical and apical posterior bristle. Hind femora with four to six anteroventral bristles on basal one-half to two-thirds. Hind tibiae with a median anterodorsal and anteroventral bristle, basad the anterodorsal bristle with two or three weaker bristles and occasionally with one apicad of the median anterodorsal one.

Wings very slightly yellowish hyaline, especially at base; third and fourth veins slightly convergent apically. Calyptrae white; halteres yellow.

Abdomen black, grayish pruinescent; the apical lateral margins of the tergites pale fulvous. Basal tergite with a pair of large, subtriangular, brown spots which extend from base of tergite to the lighter colored, narrow, apical area; the spots on fourth visible tergite confluent at base, others distinctly separated.

FEMALE: Length 5.5 to 6.5 mm. Very similar to the male, the anteroventral and posteroventral bristles on mid and hind femora absent. Abdominal spots more diffuse and extensive.

TYPE MATERIAL: Holotype, male; allotype, female; and paratypes, 15 males and three females; all from Natal, Brazil, February 5 to 24, 1943 (F. M. Snyder).

The holotype is unique in possessing a single median posterodorsal bristle on the right hind tibia which is absent in all other specimens. This species and *lisarba* were both taken together along margins of a ditch carrying off septic tank effluent as well as along margins of a brackish tidal pool on the beach near the seashore.

Lispe levis Stein

Lispe levis STEIN, 1911, Arch. Naturgesch., sect. A, vol. 77, p. 148.

This species was described from Arica, Chile. The preceding two species agree in many respects with Stein's description, having in common the anterodorsal bristle on the mid tibiae and broadened apical fore tarsal segment. The larger size of *levis* (8 mm.) and the three postsutural dorsocentral bristles should separate it. I have seen no specimens of *levis*.

Lispe setuligera Stein

Lispe setuligera STEIN, 1911, Arch. Naturgesch., sect. A, vol. 77, p. 146; MALLOCH, 1934, Diptera of Patagonia and south Chile, pt. 7, fasc. 2, p. 278.

I have not seen this species, which is apparently widely distributed in southern Argentina and Chile.

Lispe edwardsi Malloch

Lispe edwardsi MALLOCH, 1934, Diptera of Patagonia and south Chile, pt 7, fasc. 2, p. 278.

A male from Rio de Janeiro, Brazil, agrees in most respects with Malloch's description. However, the tibiae, instead of being entirely black, are brownish fulvous, and the pruinescence along lateral margins of thoracic disc is yellow instead of gray. Two females from Rio de Janeiro and Natal, Brazil, and one female from Ixtepec, Mexico, agree well with the male except the lighter central abdominal spots are broader and more distinct. The head and legs are bristled similarly in both sexes. The long, slender, ventral bristle near base of the hind femora should help to separate it from all known Neotropical species.

Lispe tentaculata (DeGeer)

Musca tentaculata DeGeer, 1776, Mémoires pour servir à l'histoire des insectes, vol. 6, p. 86.

Stein has recorded this species from Lima, Peru. I have taken it along a fresh-water stream near Guatemala City, Guatemala. The female of *villis* Stein is unknown, but it is likely to be quite similar to *tentaculata*.

Lispe planiseta, new species

Male: Length 6 mm. Head black, face, cheeks and lower half of occiput grayish pruinescent and dorsal half of occiput grayish blue pruinescent. Posterior half of parafrontals and frontal vitta velvety black, frontal triangle extending to base of antennae as a long, narrow, grayish line. Parafacials moderately wide, with a few scattered, fine hairs. When viewed in profile, the juncture of parafacials and parafrontals slightly protuberant, the parafacials narrowed below. Cheeks as high as width of third antennal segment. Antennae black, third segment one and three-fifths as long as second. Longest aristal hairs not quite so long as width of third antennal segment; hairs on lower surface of arista much shorter than those on dorsal surface and fewer in number. Palpi fulvous, only moderately dilated; proboscis shiny black.

Thorax black, pleura bluish gray pruinescent; the disc, when viewed from behind, with a median and two dorsocentral black vittae, laterad the dorsocentral vittae is a broad, sparsely grayish pruinescent area; margins of disc with dense grayish pruinescence. Scutellum concolorous with median vitta. With a grayish transverse narrow pruinescent band in front of scutellum which joins a large, gray pruinescent area adjacent to the supra-alar bristles. Acrosticals 0:1, very weak; dorsocentrals 2:3, the anterior postsutural one weak. Scutellum with a pair of strong subbasals and apicals.

Legs black; knees, fore tarsi, and mid and hind tibiae fulvous, the tibiae with grayish pruinescence so that in certain lights the mid and hind tibiae appear dark. Fore femora normal. Fore tibiae with a submedian anterodorsal and posterior bristle. Fore tarsi slightly longer than fore tibiae, with several tubercles and a peculiar, apically flattened and dilated, median, apical bristle as in figure 1. Mid femora with a median anterior and a subapical and apical posterior bristle. Mid tibiae with a submedian posterior bristle. Hind femora with a subapical and a submedian anteroventral bristle and with five to eight closely placed, almost thorn-like bristles on basal half and with a group of short thorns on basal one-eighth of posterior surface. Hind tibiae with a median posterodorsal and anterodorsal bristle and with an anteroventral one on apical one-third; basad of the anterodorsal bristle is a row of six to eight long, slender, almost hair-like bristles. Mid and hind tarsi normal.

Wings hyaline. Calyptrae white; halteres yellow.

Abdomen sublanceolate, rather long, shiny black, with a narrow white pruinescent band at apex of first to third visible tergites. Fourth tergite with a large, white lateral area at base. First to third tergites with a single lateral apical bristle and a complete row of strong apical bristles on fourth tergite.

FEMALE: Length 6 mm. Similar to the male. Thorax with the vittae brownish. The fore tarsi are black and normal. Hind femora with no anteroventral bristles but with four or five finer posterior basal setulae. Abdomen with paired, large, subtriangular black spots on second to fourth abdominal tergites which are separated by a grayish dorsocentral stripe. The apical lateral bristles on first and second tergites not developed. Other abdominal bristles as in the males.

TYPE MATERIAL: Holotype, male; and allotype, female, Robertsport, Liberia, near the village of Talla, December 4, 1943 (F. M. Snyder); numerous male and female paratypes from Robertsport, Liberia, and Accra, Gold Coast. Earliest, June 28, 1942; latest, December 8, 1943.

This is a very common species in the above localities. It was taken most commonly near fresh water, although some were collected near brackish water pools.

This species runs to *neo* Malloch in Van Emden's (1941, p. 270) key to Ethiopian *Lispe*, but it may be separated from *neo* by the three postsutural dorsocentrals and the posterodorsal bristle on the hind tibiae. It will run to *nana* Macquart in Curran's (1937, p. 2) key and may be separated from that species by the median anterodorsal and posterior bristle on the fore tibiae. The peculiar structure and armature of the fore tarsi of the male will separate it from all African *Lispe*.

LISPACOENOSIA, NEW GENUS

Front about one-third of head width in both sexes and with a single weak, reclinate, posterior parafrontal bristle; parafacials with fine hairs along their entire length; palpi moderately dilated. Only the following bristles are present on thorax: humerals 1; presuturals 1; notopleurals 2; dorsocentrals 0:1; supra-alars 1; postalars, 1 weak and 1 strong; scutellars 4; prothoracics 2; stigmatals 1; sternopleurals 3 in an equilateral triangle; mesopleura with a row of three or four bristles along posterior margin.

GENOTYPE: *Lispacoenosia fulvitarsus*, new species.

It is difficult to place this genus into its proper subfamily, since it shows affinities with both the Coenosiinae and the Lispinae. The Coenosiinae characters are the single posterior parafrontal bristle which is more reclinate than outwardly directed, the bare pteropleura, and the sternopleural bristles which are situated in a nearly equilateral triangle. The Lispinae characters are illustrated by the dilated palpi and presence of parafacial hairs and absence of presutural dorsocentral bristles. This last character is, of course, not exhibited by all of the Lispinae.

In habits it is similar to *Lispe*, being taken in grass along edges of water.

Lispacoenosia fulvitarsus, new species

MALE: Length 3.5 to 4 mm. Head black, parafacials, cheeks, lower half of occiput, and an area from neck to inner vertical bristles silvery pruinescent; face brownish gray pruinescent, oral margin with a transverse dark brown band which, when viewed in certain lights, disappears; remainder of head velvety black, except the shiny broad frontal triangle. Head shape as in figures 2 and 3. Antennae brownish black. Palpi fulvous, apically dilated as in figure 4.

Thorax shiny black, with a trace of a short, broad, triangularly shaped, silvery gray pruinescent spot on anterior margin in center of pronotum which is in line with the silvery area on back of head; notopleural area with a broad, silvery gray pruinescent area; pleura except mesonotum silvery gray pruinescent.

Legs black; posterior four tibiae and all tarsi except the fore metatarsus fulvous yellow; black portion with dense silvery gray pruinescence. Trochanters fulvous brown. Fore femora with posterodorsal and posteroventral series of bristles weak and widely separated, the latter series weakest. Fore tibiae rather broad and flattened posteriorly as in figure 5. Mid femora with a median anterior and subapical and apical posterior bristle. Hind femora with three or four short, widely spaced, anterodorsal bristles, none as long as diameter of femora where situated; other surfaces bare. Hind tibiae with a submedian anterodorsal, posterodorsal, and anteroventral bristle and with a strong apical anterodorsal and a subapical dorsal bristle and a short, weak, apical, anteroventral bristle. All tarsi normal.

Wings slightly yellowish brown hyaline, costal thorns and setulae undifferentiated; other veins bare; third and fourth veins parallel at apex; sixth vein not reaching wing margin. Seventh not curved forward. Calyptrae white, lower scale distinctly protruding beyond apex of upper. Halteres fulvous.

Abdomen sublanceolate, dorsoventrally flattened, shiny black, with a silvery gray pruinescent basal spot on declivitous portion of second to fourth visible tergites; fourth tergite only with strong bristles, a single lateral discal and a row of four apicals.

FEMALE: Length 4.5 to 5 mm. Very similar to the male. The fore femoral bristles more well developed. Hind tibiae infuscated; apical anteroventral bristle on hind tibiae strong. The lateral silvery spots on abdominal tergites more extensive and with two instead of four strong apical bristles on fourth tergite.

TYPE MATERIAL: Holotype, male, and allotype, female, *in copula*, Accra, Gold Coast, August 2, 1942 (F. M. Snyder). Paratypes: six males and five females, same data as type; one male and three females, August 3, 1942; one female, June 3, and two males, June 27 and 28; all vicinity of Accra, Gold Coast.

Some of the specimens have a very faint, median, gray-dusted, abdominal vitta.

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REVISION OF *NEOMUSCINA* TOWNSEND

By Fred M. Snyder

This little-known genus may be of some economic importance from a hygienic standpoint, although its role may be a minor one. The adults are commonly collected on feces and rotting vegetable material, while labels on specimens in several collections indicate that the adults enter houses and airplanes. Townsend, in describing the genus, mentioned they commonly entered tents and caves during the heat of the day. Curran (1934, p. 465) reports that Aldrich observed the adults deposit living larvae in feces.

In an arroyo in El Salvador, I took a long series of *nudinervis* Stein on human feces in which several individual ascarids were visible. At the same time, these flies were seen flying from the feces onto rotting mangos on the ground and onto fresh mangos that were still hanging onto the trees growing along the bank. I have also taken other species on feces and in houses in Panama, Venezuela, and Brazil.

A long series of specimens in the United States National Museum from Panama bear labels that indicate they were taken in fruit-fly traps, and others bear the label "Formes sp." It is not clear whether these latter specimens are predators of ants or were reared from their nests. The adults were also frequently collected on low-growing vegetation at the edge of, and deep in, the forest along jungle paths.

Neomuscina is predominantly Neotropical in distribution, although the genotype, *tripunctata* Van der Wulp, occurs as far north as the southwestern United States, and one species may occur in West Africa (see the discussion after *transporta*, new species).

At this time I wish to thank Drs. H. H. Ross and B. D. Burk of the Illinois Natural History Survey for comparing the accompanying description and several specimens of *tripunctata* with a cotype in the Survey's collection. Dr. F. van Emden of the Imperial Institute of Entomology, London, kindly sent notes on characters found on specimens of the genotype of *Spilopteromyia* in the British Museum (Natural History). To Dr. C. W. Sabrosky of the Division of Insect Identification of the Bureau of Entomology of the United States Department of Agriculture I am indebted for detailed notes on the cotype of *zosteris* in the United States National Museum and for comparing specimens with it. He also brought together a long series of specimens of this genus which the museum authorities made available for study. To Dr. C. H. Curran I am especially grateful for encouragement and suggestions as well as for making the specimens of this genus in the American Museum available for study and verifying several original references not available to me.

Unless otherwise stated after the description all holotypes are, or will be, deposited in the American Museum of Natural History.

NEOMUSCINA TOWNSEND

Neomuscina TOWNSEND, 1919, Proc. U. S. Natl. Mus., vol. 56, p. 541; MALLOCH, 1921, Ent. News, vol. 32, p. 41; 1925, Ann. Mag. Nat. Hist., ser. 9, vol. 16, pp. 89, 92; SÉGUY, *in* Wytsman, 1937, Genera insectorum, fasc. 205, p. 349.

Spilopteromyia MALLOCH, 1921, Ann. Mag. Nat. Hist., ser. 9, vol. 8, p. 422; SÉGUY, *in* Wytsman, 1937, Genera insectorum, fasc. 205, p. 344 (as subgenus of *Dichaetomyia*); VAN EMDEN, 1942, Ann. Mag. Nat. Hist., ser. 11, vol. 9, p. 677.

This genus may be defined as Phaoniinae that lack the posterodorsal calcar on hind tibiae and have a bare propleura and prosternum; the pteropleura has hairs in the center, and the stem vein (coalesced first and second wing veins) has one or more hairs on at least the ventral surface adjacent to the humeral cross vein; there are one or more hairs on the third vein beyond its juncture with the second (node) only on ventral surface in the subgenus *Spilopteromyia*, while the third vein is entirely bare in *Neomuscina, sensu stricto;* all other veins, except costa, are bare; the fourth wing vein has a strong, rounded forward curvature beyond the middle of the apical section, and it ends behind the wing tip. The following sclerites are bare: infra-alar bulla, postalar declivity, suprasquamal ridge, metapleura below calyptrae, and that portion of the pteropleura named the infrasquamal ridge by Van Emden (1941, p. 252). The supraspiracular convexity has short hairs or pile but lacks distinct bristles or setulae. There is no facial tubercle, and the females lack cruciate bristles on the frontal vitta; the hind coxae are bare below.

There are several other characters that are not considered at this time to be of primary generic significance, but that are possessed by all species known to me, namely: bare eyes, plumose arista, no median or submedian bristles on fore tibiae except a short anterodorsal one; notopleura with setulae adjacent to the anterior one of two bristles; sternopleurals 1:2; scutellum with hairs or setulae on sides and ventral surface at least near the basal lateral angles; hairs on the subtriangular portion of the hypopleura above the hind coxae. In all females except *capalta*, new species, there are two intra-alar bristles on each side, while in the males there are one or two intra-alars depending upon the species. There is always a pair of prescutellar acrostical bristles.

It has been my experience that the number and arrangement of the pre-apical bristles on the mid femora in related genera are quite variable within the species, but in this group they are surprisingly constant in the different species, the only exception being in a few specimens of the genotype and *nudinervis* Stein. In no species, except *Neomuscina* (*Spilopteromyia*) *apicata* (Stein), are there pre-apical mid femoral bristles on any of the anterior surfaces.

Neomuscina appears to be most closely related to certain segregates of the Neotropical *Cyrtoneuropsis* Malloch, *Airalips* Snyder, and certain groups of *Helina* Robineau-Desvoidy, *sensu lato;* it appears to link the Cyrtoneurini with the Mydaeini. Certain Ethiopian species of *Dichaetomyia* Malloch possess many of the essential characters found in species of *Neomuscina*, but the bare prosternum and more strongly curved fourth vein will invariably separate *Neomuscina* from *Dichaetomyia.*

It is of interest to note that the adults of many species of *Dichaetomyia* Malloch and most of the Cyrtoneurini are collected in environments similar to those of *Neomuscina.*

Townsend included a single species, *cavicola* Townsend, when he described *Neomuscina.* In later contributions, Malloch pointed out that *cavicola* Townsend and *Muscina texana* Hough were synonyms of *Muscina tripunctata* Van der Wulp which therefore becomes the genotype of *Neomuscina.* Malloch also showed that *Mydaea nudinervis* Stein belongs in *Neomuscina.*

In describing *Spilopteromyia,* Malloch compared it with *Dichaetomyia,* and Séguy treated it as a subgenus of *Dichaetomyia.* In working up the Ethiopian *Dichaetomyia,* Van Emden pointed out that *Spilopteromyia* and several other genera placed as subgenera of *Dichaetomyia* by Séguy were not closely related to that genus.

It appears that *Spilopteromyia* is more closely allied to *Neomuscina,* and it is my opinion that it should be treated at most as a subgenus of it. The only character that I have been able to find that may be of value in distinguishing *Spilopteromyia* from *Neomuscina, sensu stricto,* is the presence of hairs on the ventral surface of the third wing vein beyond the node; and with the discovery of a new species, *currani,* which has only a single one on this wing vein it appears that the genus definitely grades into *Neomuscina.*

Spilogaster apicata Stein, the genotype of *Spilopteromyia,* has a single pre-apical anterodorsal bristle on the mid femora which is possessed by no other species of *Neomuscina, sensu stricto,* and which might be used to distinguish *Spilopteromyia* further. However, another species, *atincticosta,* described later in the paper, possesses all the characteristics of *Spilopteromyia* but lacks the pre-apical, anterodorsal, mid femoral bristle.

KEY TO *Neomuscina* TOWNSEND, SENSU LATO

A. Third wing vein entirely bare................*Neomuscina, sensu stricto,* 1
   Third wing vein with one or more hairs on ventral surface beyond the node........................Subgenus *Spilopteromyia* Malloch, 26
1. With one or more pairs of distinct, presutural, acrostical bristles.........2
   Without distinct, presutural, acrostical bristles.......................10
2. Hypopleura with setulae below spiracle.....*tripunctata* (Van der Wulp)
   Hypopleura without setulae below spiracle..........................3
3. Mid femora with two strong, pre-apical, dorsal to posterior bristles.......4
   Mid femora with three strong, pre-apical, dorsal to posterior bristles.....5
4. With two pairs of presutural, acrostical bristles................species 1
   With one pair of presutural, acrostical bristles.......................... *zosteris* (Shannon and Del Ponte)
5. With two median anterodorsal bristles on hind tibiae.................................... *nudistigma,* new species
   With one median anterodorsal bristle on hind tibiae...................6
6. Base of femora infuscated and usually one or more coxae with dark streaks 7
   Base of femora and all coxae entirely yellow to fulvous.................9
7. Cross veins, at least, broadly infuscated.............................21
   Cross veins not broadly infuscated.................................8

8. *Males:* Intra-alars 2; eye facets not greatly enlarged above and in front .... *davida*, new species
   Males: Intra-alars 1; eyes with an area of greatly enlarged facets above and in front .... *macrops*, new species
9. Dorsocentrals normally 2:3; males with two submedian anterodorsal bristles on hind tibiae; second and third abdominal segments mostly yellow .... *triseta*, new species
   Dorsocentrals 2:4; males with a single median anterodorsal bristle on hind tibiae; second and third abdominal segments entirely infuscated.... .... *sanespra*, new species
10. Dorsocentrals 2:3 11
    Dorsocentrals 2:4 14
11. Mid femora with three pre-apical bristles, a dorsal, posterodorsal, and posterior one 12
    Mid femora with only two pre-apical bristles, usually the dorsal one is absent .... *capalta*, new species
12. Wings unspotted, hyaline... .... species 2
    Wings with at least the anterior cross vein infuscated... 13
13. Calyptrae deep brown, the margins infuscated; hind femora with a complete row of long, anteroventral bristles; third wing vein bare ventrally .... *inflexa* (Stein)
    Calyptrae white to pale yellow, the margins not infuscated; hind femora with only two or three long, anteroventral bristles at apex; third wing vein with a single ventral setula beyond node.... *currani*, new species
14. Mid femora with two pre-apical bristles 15
    Mid femora with three pre-apical bristles 21
15. Hind tibiae with two submedian, anterodorsal bristles; most of thoracic pleura infuscated 19
    Hind tibiae with one submedian, anterodorsal bristle; most of thoracic pleura fulvous 16
16. Mid and hind femora infuscated on basal half or more................. .... *mediana*, new species
    Mid and hind femora entirely fulvous to light brown 17
17. Margins of calyptrae infuscated .... *fulvifrons*, new species
    Margins of calyptrae not infuscated 18
18. With an uninterrupted dark cloud from apex of subcostal vein to apex of second vein; fore tibiae with a short, submedian, anterodorsal bristle .... *nigricosta*, new species
    With a distinct spot at apex of subcosta and a faint spot towards apex of second vein; fore tibiae without a short, submedian, anterodorsal bristle .... *transporta*, new species
19. Cross veins and costal margin with faint but distinct darkened clouds; hind femora with a complete row of strong, posteroventral bristles..20
    Cross veins and costal margin without trace of darkened cloud; hind femora with only two to four posteroventral bristles on basal one-half .... *atincta*, new species
20. Thorax and femora entirely fulvous .... *transporta*, new species
    Thorax and mid and hind femora mostly infuscated . *nudistigma*, new species
21. Posterior thoracic spiracle with several black setulae in at least the postero-

ventral corner in addition to the flap-like coverings of hairs........22
Posterior thoracic spiracle without any black setulae in addition to the flap-like covering of hairs....................................23
22. Thoracic pleura and femora fulvous........*nudinervis fulva*, new subspecies
Thoracic pleura and femora mostly infuscated....................................*nudinervis nudinervis* (Stein)
23. Wings with infuscated areas....................................25
Wings without infuscated areas....................................24
24. At least posterior four femora infuscated on basal three-fourths or more; male with intra-alars 1.......................*instabilis*, new species
All femora fulvous; male with intra-alars 2...........*schadei*, new species
25. Posterior four femora infuscated...................*similata*, new species
Posterior four femora mostly fulvous.............*neosimilis*, new species
26. Dorsocentrals 2:3..............................*currani*, new species
Dorsocentrals 2:4....................................27
27. Costal margin darkened....................................28
Costal margin not darkened.....................*atincticosta*, new species
28. Margins of calyptrae infuscated.....................*tinctinervis* Stein[1]
Margins of calyptrae not infuscated..................... *apicata* (Stein)

Neomuscina tripunctata (Van der Wulp)

Muscina tripunctata VAN DER WULP, 1896, Biologia Centrali Americana, vol. 2, p. 305.

Muscina texana HOUGH, 1900, Biol. Bull., vol. 1, p. 25.

Neomuscina cavicola TOWNSEND, 1919, Proc. U. S. Natl. Mus., vol. 56, p. 541.

Neomuscina tripunctata, MALLOCH, 1921, Ent. News, vol. 32, p. 41; 1925, Ann. Mag. Nat. Hist., ser. 9, vol. 16, p. 92.

MALE: Length 8 mm. Head fulvous, back of head and posterior portion of frontal vitta darkened, densely white pruinescent. Front at narrowest about as wide as distance across posterior ocelli inclusive. Frontal vitta at narrowest part 1.0 to 2.0 times as wide as diameter of anterior ocellus. With a complete row of parafrontal bristles which become shorter posteriorly, the posterior pair backwardly and outwardly directed, about as long as anterior pair. The anterior series of parafrontal bristles inwardly directed and those on posterior half inwardly and forwardly directed. Anterior ocellar and subapical parafrontal bristles subequal and stronger than others. In profile, juncture of parafacials and parafrontals 0.75 as long as greatest width of third antennal segment, parafacials scarcely narrowed below. Cheeks about twice as high as width of third antennal segment. Facial ridges with black setulae continued to opposite middle of third antennal segment. Antennae fulvous, slightly darker

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[1] This species not seen but included on basis of Stein's description.

apically, inserted slightly above middle of eyes and extending to opposite lower margin; third segment about 2.25 times as long as second. Longest aristal hairs a little longer than greatest width of third antennal segment. Palpi yellowish fulvous, proboscis shiny brown. Eye facets slightly larger in center in front.

Thorax black, the humeri, postalar callosities, apex and ventral surface of scutellum fulvous, with yellowish gray pruinescence, quadrivittate, usually with a variable fulvous spot near base of pra. With a pair of distinct brown median vittae and a less distinct, but broader, lateral pair, in certain views, with a median vitta from base of scutellum to transverse suture. Acrosticals 1:1; dorsocentrals 2:4; intra-alars 2; pra very short but distinct. Scutellar setulae descending onto ventral surface at basal lateral angles; hypopleura with some longer hairs in front of spiracle and above base of hind coxae and with some shorter ones below spiracle. The spiracle without simple black setulae among the yellow flap-like covering of hairs. Supraspiracular convexity with moderately long, fine, pale hairs.

Legs fulvous. Fore femora normal. Fore tibiae with one strong and one weak subdorsal and one strong posteroventral apical bristle. Mid femora with three or four basal anteroventral and with longer and more widely spaced ventral bristles on basal half and with one pre-apical subdorsal, posterodorsal, and posterior bristle. Mid tibiae with two strong and one to two weaker posterior bristles. Hind femora with a row of anteroventral bristles, only the pre-apical two or three as long as, or longer than, greatest diameter of femora where situated, and with a row of more slender posteroventral bristles on basal one-half. Hind tibiae with two or three median anterodorsal and two anteroventral bristles. The posterodorsal setulae slightly longer and more upstanding than usual.

Abdomen yellowish brown, darker towards apex, with grayish pruinescence, second and third visible tergites with a median basal dark spot and the fourth with indications of a narrow darker median vitta. Second tergite with a few short lateral apical bristles, the third with two median and three or four lateral apical bristles which are stronger than those on second. The fourth with a row of strong discals, subapicals, and apicals. Basal sternite setulose; others, except fifth, with several strong apicals. Hypopygium fulvous.

Wings faintly yellowish hyaline, more yellow along costal margin. Stem vein with several long hairs on dorsal and ventral surface opposite humeral cross vein. Anterior cross vein with a very faint yellow cloud; posterior cross vein slightly curved. Fourth vein strongly curved forward, ending slightly behind wing tip. Calyptrae faintly yellow. Halteres pale fulvous.

FEMALE: Length 8 mm. Similar to the male. Front at vertex 0.33 of greatest head width, almost parallel sided. With about three strong, parafrontal bristles on each side between which are shorter and weaker bristles. The posterior two pair outwardly, others inwardly, directed. Inner and outer vertical and subapical parafrontal bristles subequal, stronger than other bristles on front. Palpi a little wider, particularly at apex. The fulvous area on scutellum and near pra more extensive, and the median thoracic vitta more distinct.

Fore tibiae with the apical posterodorsal bristle stronger. Mid femora with the anteroventral and posteroventral bristles subequal, shorter than in the male. Anteroventral and posteroventral bristles on hind femora shorter and less numerous.

SPECIMENS EXAMINED: Two males and one female, paratypes of *cavicola* Townsend from New Mexico and Arizona in the United States National Museum, and 11 males and 21 females from Arizona.

An occasional specimen in the above series lacks the preapical, posterodorsal, mid femoral bristle on one side, and the body color in one paratype is slightly darker than described.

Dr. Burk kindly sent several notes on the cotype of *tripunctata* Van der Wulp in the Illinois Natural History Survey Collection in which he states that the specimen is rubbed, but apparently hypopleural hairs below the spiracle are present. The width of the narrowest part of the front as compared to the distance across the posterior ocelli inclusive in cotype is six compared to seven units while in specimens sent for comparison the proportion is 12 to 10, respectively. Thus the actual width in these specimens is almost twice as wide but the proportional width of front is essentially about as wide as distance across posterior ocelli inclusive. The hind femoral bristles are said to be the same in cotype and the specimens compared with it, "but hind femur slightly stouter in type."

Neomuscina zosteris (Shannon and Del Ponte)

? *Mydaea sparsiplumata* STEIN, 1918, Ann. Hist. Nat. Mus. Natl. Hungarici, vol. 16, p. 218.

Muscina zosteris SHANNON AND DEL PONTE, 1926, Rev. Inst. Bact., Buenos Aires, vol. 4, p. 579.

Neomuscina zosteris SHANNON AND DEL PONTE, 1927, Rev. Inst. Bact., Buenos Aires, vol. 5, pp 142, 146.

MALE: Length 6.5 to 7.0 mm. Head yellowish, with grayish pruinescence. Upper half of back of head black. Front at narrowest part 1.2 times as wide as diameter of anterior ocellus. Parafrontals contiguous for a short distance at middle of front. With three or four pairs of parafrontal setulae and numerous shorter setulae reaching to opposite anterior ocellus. Outer verticals, anterior and posterior ocellar and pre-apical parafrontal bristles subequal. Juncture of parafacials and parafrontals 0.9 of width of third antennal segment, the parafacials narrowed to 0.66 of antennal width below. Cheeks 1.6 times as high as width of third antennal segment. Antennae yellow, third segment about 3.5 times as long as second. Antennae inserted opposite middle of eyes, extending slightly below lower level of eyes. Aristal hairs more widely spaced than usual; the longest are about as long as greatest width of third antennal segment. Palpi and proboscis fulvous yellow, the latter shiny.

Humeri and apex of scutellum yellow, remainder of thorax yellowish brown, grayish pruinescent, with two vittae inside the row of dorsocentral bristles and with a wider vitta outside, which is interrupted at the transverse suture. Acrosticals 1:1; dorsocentrals 2:4; intra-alars 2; pra 0.6 as long as posterior notopleural bristle. Without black setulae among the flap-like covering of hairs of posterior thoracic spiracle.

Legs yellowish, becoming slightly brownish apically, the tarsi definitely brownish. Fore tibiae with a very short, submedian, anterodorsal bristle, the apical dorsal, posterodorsal, and posteroventral bristles almost equal. Mid femora with a complete row of rather long, fine, ventral bristles and a row of short, but stout anteroventral bristles on basal half and with a pre-apical posterodorsal and posterior bristle. Hind tibiae with three posterior bristles. Hind femora with a row of anteroventral bristles which are stronger on apical one-half and with a row of slender bristles on basal two-thirds. Hind tibiae with a median anterodorsal and two to three anteroventral bristles.

Wings hyaline, very light yellowish brown. Cross veins infuscated, the anterior one most distinct. Calyptrae very pale brown, in certain views margins darker. Halteres yellow. Posterior cross vein moderately curved.

Abdomen brownish, first segment, except a narrow brown apical band and basal half of second, yellow. With an indistinct median basal spot on second and third segments; grayish pruinescent except at base of the clothing setulae. Basal sternite setulose, others with a row of apical bristles.

This description is based on one male from Tucuman, Argentina (Parker), the type locality of *zosteris*. Dr. Sabrosky compared this specimen with a cotype of *zosteris* in the United States National Museum and considered them conspecific, although the ground color of the cotype is lighter.

I strongly suspect that *Mydaea sparsiplumata* Stein is the same as *zosteris*, since the above specimen agrees quite well with Stein's description, except that the color is lighter and in this respect agrees quite well with the type of *zosteris*. However, *zosteris* is tentatively considered to be distinct until the type of *sparsiplumata* can be examined for several characters not mentioned in its description.

Neomuscina species 1

There is a single female specimen from Santa Cruz, Rio Grande do Sul "Fr. Stieglmayr leg. July 10" in the United States National Museum which it is believed Malloch determined as *zosteris*. It possesses two pairs of presutural acrostical bristles, but in other respects agrees with the cotype of *zosteris*. Until more material can be examined to determine the constancy of this character, I prefer to treat it as a possible variant without naming it. It is of interest to note that it is from the same locality and taken by the same collector as Stein's *sparsiplumata*.

Neomuscina triseta, new species

MALE: Length 8.5 mm. Head 2.0 times as high as long, fulvous, grayish white pruinescent, the back of head to lower one-third of eyes black. Front at narrowest part not so wide as diameter of anterior ocellus. Parafrontals and parafacials narrow along their entire length, not much wider than greatest aristal diameter, in profile they are visible only at their juncture. Cheeks as high as width of third antennal segment. With four or five pairs of well-developed anterior parafrontal bristles, and with a row of very short ones extending posteriorly to anterior ocellus. Anterior and posterior ocellar, inner and outer vertical bristles short, but distinct, subequal, weaker than the strongest parafrontals. Facial ridges with short setulae continued to opposite insertion of arista. Eyes large, the facets on the dorsal anterior portion enlarged. Antennae yellow fulvous, inserted opposite center of eyes and extending to opposite the ventral margin. Third antennal segment 2.8 times as long as second. Longest aristal hairs as long as width of third antennal segment. Palpi and proboscis fulvous, the latter shiny.

Thoracic dorsum, hypopleura, pteropleura below the infra-alar bulla, and metapleura brown; the humeri, apex, and ventral surface of scutellum and balance of pleura fulvous; all parts are gray pruinescent, the disc distinctly quadrivittate. Acrosticals 1:1; dorsocentrals 2:3; intra-alars 2; pra 0.5 as long as anterior notopleural bristle; hypopleura with a few setulae only above hind coxae. Scutellar setulae descending onto ventral surface except at apex. Posterior thoracic spiracle without accessory setulae.

Legs entirely fulvous. Fore femora normal. Fore tibiae with a very short, median, anterodorsal and a few shorter, scarcely developed setulae towards apex, apical anterior, posterodorsal, and posteroventral bristles strong, subequal. Mid femora with a row of about six long ventral bristles on basal two-thirds and with a few weaker anteroventral ones on basal one-half, with one preapical dorsal posterodorsal and posterior bristle. Mid tibiae with two strong median posterior bristles and one or two much shorter ones beyond. Hind femora with a complete row of anteroventral bristles, the apical three or four more robust and with a row of posteroventral bristles on basal two-thirds to one-half. Hind tibiae with one long and one shorter median anterodorsal bristle, with three short median anteroventral bristles.

Wings yellowish hyaline, the costal area slightly more yellowish, but without a distinct cloud. Posterior cross vein with a mere trace of an infuscated cloud. Coastal setulae and thorns scarcely developed. Posterior cross vein slightly curved. Calyptrae brownish hyaline, margins of both dark brown. Halteres yellow.

FEMALE: Length 8.5 mm. Similar to the male, differing from it in having the front at vertex 0.27 of greatest head width widened to 0.3 anteriorly. The parafrontals 2.0 times as wide as diameter of anterior ocellus, clearly visible in profile. With a complete row of parafrontal bristles, the posterior two pairs outwardly, the others inwardly directed. Frontal vitta brownish black, slightly reddish anteriorly. Inner and outer vertical bristles strong, as well developed as the subapical parafrontal bristles. The anterior ocellars shorter but more well developed than postocellar bristles. Hind tibiae with only one anterodorsal bristle and two or three median anteroventral bristles. Third visible abdominal tergite with only the apical row of bristles, fourth with the apical row much reduced, scarcely discernible.

TYPE MATERIAL: Holotype, male, Guatemala City, Guatemala, 5000 feet, August 20, 1943 (F. M. Snyder); allotype, female, Antigua, Guatemala, June 23, 1923 (E. G. Smyth); paratypes, female, Cuernavaca, Mexico, 5000 feet, August 15, 1943 (F. M. Snyder).

There is a male from La Provedencia, Guatemala (C. M. Roullard), in the United States National Museum which agrees in all respects with the type series except that there are four pairs of postsutural dorsocentral bristles. This is, I suspect, an unusual specimen. It can be separated from *sanespra* by the other characters mentioned in the key as well as by the lighter-colored abdomen and its larger size.

Neomuscina sanespra, new species

MALE: Length 7 mm. Head yellow with grayish yellow pruinescence; upper half of back of head black, grayish pruinescent. Front at narrowest part as wide as diameter of anterior ocellus. Parafrontals contiguous for about 0.45 of their length, with a complete row of bristles and setulae, anterior four pairs strongest. Juncture of parafacials and parafrontals about 0.25 as long as width of third antennal segment, the parafrontals almost obscured below. Cheeks as high as width of third antennal segment. Antennae inserted opposite the lower 0.42 of eye, extending to slightly below lower level. Antennae fulvous yellow, third segment 3.2 times as long as second. Longest aristal hairs 1.25 times as long as greatest width of third antennal segment. Palpi yellowish fulvous. Proboscis brown.

Thorax fulvous, the dorsum except humeri reddish brown with dense grayish pruinescence, with four indistinct vittae. Acrosticals 1:1; dorsocentrals 2:4; intra-alars 2; pra 0.6 as long as posterior notopleural bristle. Propleural bristle brownish yellow and the single stigmatal bristle black, neither of these bristles with obvious strong accessory bristles. Posterior thoracic spiracle without accessory setulae among the flap-like covering of hairs.

Legs yellow, the posterior four pairs become gradually brownish from trochanter to tarsi. Fore tibiae with a distinct submedian anterodorsal setula and with strong subequal apical dorsal, posterodorsal, and posteroventral bristles. Mid femora with a complete row of slender posteroventral and a row of similar anteroventral bristles on basal one-half. Mid tibiae with two strong, submedian, posterior bristles and with several shorter ones between and beyond. Hind femora with a complete row of anteroventral bristles and a row of posteroventral bristles on basal one-half. Hind tibiae with a median anterodorsal bristle and with three more slender anteroventral median bristles.

Wings hyaline, slightly yellowish brown. Anterior cross vein with a scarcely discernible narrow cloud. Posterior cross vein slightly curved. Calyptrae yellowish brown; margins, especially of upper one, darker brown when viewed above and in front. Halteres yellowish.

Abdomen brownish black, bluish gray pruinescent. Extreme lateral basal area of first visible segment yellowish brown and with an indistinct basal dark spot on second and third visible segments. The pruinescence absent at base of clothing setulae so that the bristles appear to be inserted in shiny spots. Basal sternite fulvous, each of the other sternites dark towards apex. With a row of strong apical bristles except on fifth.

HOLOTYPE: Male, Espirito Santo, Brazil, in United States National Museum.

The left mid and hind legs are missing and the right mid leg is rather twisted, so that it is difficult to see clearly the apex of the femora. The apical posterodorsal and posterior bristles are clearly visible, and there appears to be the socket of a dorsal bristle. For this reason it is keyed as having three subapical bristles. If there are actually two, it will run to *zosteris* and may be separated from it by the longer and more closely placed aristal hairs and the darkened abdomen. It appears closely related to *fulvifrons*, new species, but the presence of a pair of presutural acrostical bristles and the more ventrally inserted antennae should separate *sanespra*.

This is the only species in *Neomuscina, sensu lato,* known to me that lacks the usual one or two strong black accessory bristles adjacent the prothoracic and stigmatal bristle.

Neomuscina davida, new species

MALE: Length 6 to 7 mm. Head 2.5 times as high as long, fulvous, grayish pruinescent, the lower posterior portion of cheeks and back of head black to brown. Front at narrowest part about 2.0 times as wide as diameter of anterior ocellus. Parafrontals normally very narrowly separated at narrowest part, each about 0.8 as wide as diameter of anterior ocellus. With about five pairs of inwardly directed, anterior, parafrontal bristles. The posterior pair of parafrontal bristles strong, outwardly and backwardly directed. In profile, juncture of parafacials and parafrontals 0.3 to 0.33 as long as width of third antennal segment, parafacials narrowed below. Cheeks as high as width of third antennal segment. Facial ridges with setulae continued dorsally to about opposite dorsal one-third of third antennal segment. Antennae fulvous, in profile inserted opposite middle of eyes, extending to slightly above lower margin of eyes. Third antennal segment 2.25 times as long as second. Arista with longest hairs slightly longer than width of third antennal segment. Palpi fulvous; proboscis dark brown to black, sparsely grayish pruinescent. Eye facets very slightly enlarged in front above base of the antennae.

Thorax black to dark brown; humeri, postalar callosity, and a variable apical portion of scutellum yellowish, with dense, slightly yellowish gray pruinescence. With four brown vittae, the two median ones narrow. Acrosticals 1:1, the presutural pair 0.5 to 0.66 times as long as anterior presutural dorsocentral; dorsocentrals 2:4; intra-alars 2; pra short but distinct. Scutellar setulae descending to, but not onto, the ventral surface except at extreme lateral angle. Hypopleura sometimes with a few pale hairs in front of spiracle. Posterior spiracle without simple setulae interspersed among the flap-like covering of hairs.

Legs brownish fulvous, the base of fore femora and basal two-thirds to three-fourths of mid and hind femora infuscated. Fore femora normal. Fore tibiae with a very weak, submedian, anterodorsal setula and a few weaker ones beyond, none longer than tibial diameter; apical dorsal, posterodorsal, and posteroventral bristles well developed, the posterodorsal one shortest.

Mid femora with five to seven ventral bristles on basal half and with a pre-apical dorsal, posterodorsal, and posterior bristle. Mid tibiae with two median posterior bristles and with a few weaker ones beyond. Hind femora with a complete row of anteroventral bristles, those on apical half are longest and with a row of posteroventral ones on basal one-half to two-thirds. Hind tibiae with a median anterodorsal and two to four weaker anteroventral bristles.

Wings brownish yellow hyaline, slightly darker towards costal margin. Without distinct spots. Posterior cross vein distinctly curved. Calyptrae yellowish, the halteres darker.

Abdomen black, grayish pruinescent, basal two segments slightly yellowish at base and with a transverse dark apical band. Second to fourth tergites with a dark central basal spot. Third tergite with three lateral apical bristles, the fourth tergite with a row of strong discals and subapicals and with a row of shorter and weaker apical bristles. Basal sternite brownish orange, setulose. Second with four to six strong apical bristles, others except fifth with two apical bristles.

FEMALE: Length 7 mm. Similar to the male, front at vertex 0.3 of head width, parallel sided, black except on apical one-third where it is fulvous. Parafrontals broader, with a row of six to eight parafrontal bristles, the posterior two pairs outwardly directed. Inner and outer verticals, anterior ocellars, and anterior parafrontal bristles long and strong, subequal. Abdominal bristles weaker.

TYPE MATERIAL: Holotype, male, David, Republic of Panama, June 6, 1943 (F. M. Snyder); allotype, female, El Cermeno, Panama, December, 1939, to January, 1940, fruit-fly trap (Zetek). Paratypes: Five males, same data as holotype; one male, Natal, Brazil, October 8 to 20, 1943 (F. M. Snyder); one female, Maturin, Venezuela, May 20, 1943 (F. M. Snyder).

Additional records from Higuito, San Mateo, Costa Rica (Pablo Schild), and 8 kilometers west of San José, Costa Rica, November–December, 1924, El Cermeno and Barro Colorado Island, Panama.

A male and female from San José, Costa Rica, have the abdomen with the fulvous areas more extensive but agree in all other respects with the type series.

This species is very similar to *instabilis* but may be separated from it in the male sex by the two intra-alar bristles on each side, slightly wider front, and stronger, forwardly directed posterior series of parafrontal bristles. The females are less easily separated except for the presence of presutural acrostical bristles and the slightly more fulvous basal abdominal tergites.

Neomuscina macrops, new species

MALE: Length 6 mm. Head fulvous, grayish pruinescent, back of head dark from top to middle. Front at narrowest part about as wide as greatest diameter of arista. Parafrontals contiguous and extremely narrow along most of their length, separated only near base of antennae. In profile, juncture of parafacials and parafrontals about 0.25 of width of third antennal segment, almost obscured below. With four to six pairs of rather weak, anterior, parafrontal bristles and with a few scarcely discernible ones along posterior half, only the posterior pair of this last group distinct. Cheeks as high as width of third antennal segment. Facial ridges with setulae to opposite about basal one-third of third antennal segment. Antennae and palpi yellowish fulvous; third antennal segment 2.75 times as long as second. Aristal hairs as long as width of third antennal segment. Proboscis shiny brown. Eyes with an area of greatly enlarged facets on dorsal half in front, the largest facets at least three times as large as the smallest ones so that the eyes appear to have two sections.

Thorax brown, grayish pruinescent, humeri fulvous. Bristled and marked as in *davida* but with a single intra-alar bristle on each side.

Legs as in *davida* but slightly darker in color; the bristles on hind femora are longer than the corresponding ones in that species.

Wings hyaline; calyptrae white; halteres yellow.

Abdomen brownish, slightly bluish gray pruinescent, with a dark median basal spot on second and third visible tergites. Apex of first and second visible tergites with an indistinct apical dark band; third with two or three lateral apical bristles; fourth with a row of strong discal, subapical, and apical bristles. Basal sternite hairy.

HOLOTYPE: Male, Caracas, Venezuela, 3000 feet elevation, September 25, 1943 (F. M. Snyder).

Neomuscina capalta, new species

MALE: Length 6 mm. Head three times as high as long, brownish fulvous, grayish pruinescent; back of head to lower margin of eyes black. Front at narrowest part not so wide as diameter of anterior ocellus. Parafrontals and parafacials very narrow along their entire length, not so wide as greatest diameter of arista except at their juncture with parafacials where they are 0.5 of greatest aristal diameter; in profile they are scarcely visible. Cheeks as high as width of third antennal segment. With a complete row of very short parafrontal setulae, only the pre-apical pair very well developed and equal to the anterior ocellar, the inner and outer vertical bristles. The very strong posterior ocellar bristles as long and strong as the anterior presutural dorsocentral bristles. Facial ridges with very short setulae which continue to opposite middle of third antennal segment. Eyes large, the facets in front enlarged. Antennae fulvous, inserted opposite lower 0.4 of eyes, extending to slightly below lower margin of eyes; third segment 3.0 times as long as second. Aristal hairs sparse, the longest about as long as width of third antennal segment. Palpi fulvous; the dark brown proboscis shiny.

Thorax black, the humeri and apical margin of scutellum fulvous with brownish gray pruinescence over dorsum. Four very narrow dark vittae are scarcely visible. Dorsocentrals 2:3, the anterior presutural pair weak; intra-alars 1; pra short, 0.5 as long as anterior notopleural bristle. Scutellar setulae descending onto ventral surface at base. Posterior thoracic spiracle with one or more accessory setulae in the posteroventral corner in addition to flap-like covering of hairs.

Legs very dark brown to black, the anterior coxae, apices of femora, and the fore tibiae light brown. Fore femora normal. Fore tibiae bare at middle, the apical bristles strong but the posterodorsal ones shorter than others. Mid femora with one pre-apical posterior and posterodorsal bristle, the ventral setulae weak. Mid tibiae with three to five median posterior bristles. Hind femora with some moderately developed anteroventral bristles, those on apical half stronger and slightly longer. Hind tibiae with one median anterodorsal and two to three weaker median anteroventral bristles.

Wings slightly brownish with a dark brown cloud from apex of subcosta to apex of second vein extending posteriorly to second vein, both cross veins infuscated. Costal setulae and thorn scarcely developed. Posterior cross vein nearly straight. Calyptrae and halteres pale brown.

Abdomen black, grayish pruinescent, with dorsal and lateral checkerings. Two or three strong, lateral, apical bristles on third visible tergite and a row of strong discal and weaker apical bristles on fourth. Basal sternite hairy.

TYPE MATERIAL: Holotype, male, Port of Spain, Trinidad, September 29, 1943 (F. M. Snyder); paratype, male, Barro Colorado Island, Canal Zone, February 13, 1929 (C. H. Curran).

There are three males and two females from Barro Colorado Island, June, 1942 (J. Zetek) bearing the label "Formes sp." in the United States National Museum collection which are teneral. The wings have only faint clouds or are clear, as may be expected with teneral specimens. The females are unique in the genus as they possess only a single intra-alar bristle on each side.

Neomuscina inflexa (Stein)

Cyrtoneurina inflexa STEIN, 1918, Ann. Hist. Nat. Mus. Natl. Hungarici, vol. 16, p. 223.

One male from Nova Teutonia, Brazil, April 6, 1939, latitude 27° 11′ S., longitude 52° 23′ W. (Fritz Plaumann) which I tentatively identify as this species agrees quite well with Stein's description but is smaller, 6 compared to about 8 mm. long, and the body color is more castaneous. Additional descriptive notes are as follows:

Third antennal segment 2.5 times as long as second. Facial ridge with setulae continued to opposite insertion of arista. Proboscis shiny brown. Intra-alars 1; scutellar setulae descending onto ventral surface of scutellum. Hypopleura with hairs only above hind coxae. Posterior thoracic spiracle without accessory setulae. Mid femora with a row of ventral bristles on basal two-thirds and with a pre-apical dorsal, posterodorsal, and posterior bristle. Basal abdominal sternite hairy; others with moderately well-developed apical bristles except fifth.

Stein, in a note following the description of *Mydaea tinctinervis*, states that *inflexa* is very similar in habitus to that species which is described as having some short bristles at base of third wing vein. If *inflexa* has third wing vein hairs, then I have obviously incorrectly identified the above specimen.

Neomuscina species 2

There is a specimen from Tapachula, Mexico, August 17 to 19, 1943 (F. M. Snyder), which is quite similar in structure to *currani* except there are no hairs on third vein. Wings are entirely hyaline, and the general body color appears to be fulvous. Because of its teneral condition I hesitate to name it.

Neomuscina mediana, new species

FEMALE: Length 6 25 mm. Head fulvous brown, whitish pruinescent, darkened from top of head to its lower half. Front darkened on basal one-half; at vertex, front 0.26 of head width, parallel sided. With four pairs of strong, inwardly directed, parafrontal bristles between which are one or two shorter pairs and with two posterior ones which are backwardly and outwardly directed. Anterior parafrontals, anterior ocellar, inner and outer vertical bristles subequal. Cheeks 1.2 times as high as width of third antennal segment. The setulae on facial ridge continued to a point opposite insertion of arista. Antennae fulvous orange, slightly darker apically, inserted opposite middle of eyes and extending to lower level. Third antennal segment almost 4.0 times as long as second. Longest aristal hairs as long as width of third antennal segment. Palpi fulvous. Proboscis shiny brown.

Thorax fulvous brown, grayish yellow pruinescent, along the mid-line inside the dorsocentral bristles is a dark castaneous brown stripe overlaid with dense pruinescence, on each side of which is a dark brown vitta. Along the outer side of the dorsocentral bristles is a moderately wide, lighter brown vitta. Scutellum slightly lighter at tip, with a dark area along the sides near the base and with a silvery pruinescent spot on disc inside each basal scutellar bristle. Dorsocentrals 2:4; intra-alars 2; pra 0.5 as long as the strong, anterior, notopleural bristle. Scutellar setulae descending to, but not onto, the ventral surface except on basal lateral angle. Hypopleura haired above hind coxae and in front of spiracle. The latter without interspersed simple setulae.

Fore legs fulvous, mid and hind legs brown, the femora infuscated on basal two-thirds to three-fourths. Fore femora normal. Fore tibiae with a short but distinct median anterodorsal bristle, and with the apical bristles strong, the posteroventral longest, the dorsal and posterodorsal subequal. Mid femora with four to five ventral bristles on basal one-half and with a pre-apical posterodorsal and posterior bristle. Mid tibiae with five to seven posterior bristles, two towards the base of the series longest. Hind femora with four strong anteroventral bristles on apical one-third and with three to four more slender posteroventral bristles on basal half. Hind tibiae with one median anterodorsal and two median anteroventral bristles.

Wings hyaline; with a brownish spot between apex of subcosta and first vein which is subconfluent with another spot around anterior cross vein, a less distinct, long narrow cloud towards apex of second vein, and with a faint cloud around the very slightly curved posterior cross vein. Calyptrae yellowish white. Halteres pale fulvous.

Abdomen dark brown to black, with bluish white pruinescence. The base of first visible tergite pale brown. With only a very faint basal median spot on second and third tergites and a faint apical band on second. Third tergite with two to three apical lateral bristles and with a row of discal and subapical bristles on fourth tergite. Basal sternite fulvous, setulose.

HOLOTYPE: Female, Botanical Garden, Rio de Janeiro, Brazil (H. Souza Lopes).

Neomuscina fulvifrons, new species

FEMALE: Length 6 mm. Head entirely fulvous except for two round infuscated spots on back on each side between neck and dorsolateral portion, whitish pruinescent. The ocellar tubercle rather brown, whitish pruinescent, and the very narrow frontal triangle fulvous brown. Front at vertex 0.26 of head width and only very slightly widened anteriorly. With three pairs of strong and three or four pairs of weaker parafrontal bristles, the weaker ones inserted between the stronger ones, all except the posterior two pair are inwardly directed, while the latter are outwardly directed. Anterior ocellars, inner and outer vertical bristles strongest; the postocellar and the strong parafrontal bristles subequal. Juncture of parafacials and parafrontals about 0.66 as long as width of third antennal segment; the parafacials narrowed below. Antennae fulvous, inserted slightly above middle of eyes and extending to slightly below lower level of eyes. Third antennal segment 3.2 times as long as second. Aristal hairs rather sparse, the longest almost as long as greatest width of third antennal segment. Cheeks as high as width of third antennal segment. The pale hairs on facial ridges continued to opposite about the middle of third antennal segment. Palpi pale fulvous. Proboscis shiny fulvous.

Thorax fulvous, the dorsum more brownish fulvous, densely grayish pruinescent; with four vittae, the lateral ones are widest. Apex of scutellum yellowish fulvous. Bristled as in *mediana*, but usually without hypopleural hairs in front of the spiracle.

Legs fulvous. Fore femora normal. Fore tibiae with a very short, median, anterodorsal setula and with a few shorter ones beyond; with the apical anterior, posterodorsal, and posteroventral bristles strong, subequal. Mid femora with about six ventral bristles on basal half and with about three shorter and more slender anteroventral ones on basal one-fourth; with a preapical posterodorsal and posterior bristle. Mid tibiae with three to five posterior bristles. Hind femora with a row of anteroventral bristles, only those on apical one-third longer than femoral diameter and with about three widely placed, slender, posteroventral bristles on basal half which are about as long as femoral diameter.

Wings pale brownish hyaline; with a very faint cloud around anterior cross vein. Posterior cross vein very slightly curved. Calyptrae pale brownish yellow, the upper one slightly darker than the lower one; with a dark brown border on upper one and usually there is a dark border on lower one. Halteres fulvous.

Abdomen brownish fulvous, the apical half of second and the entire third and fourth tergites are darker; all with light bluish white pruinescence which surrounds the brown spots in which the clothing setulae are inserted. Basal tergite with a very narrow, dark apical band, second with a broader apical band, second and third tergites with a small basal dark spot. The second and third tergites have three or four apical lateral bristles and fourth has a row of discals and subapicals. Sternites pale yellow; the basal one setulose, others with a pair of apical bristles.

Type Material: Holotype, female, Itaquaquecetuba, São Paulo, Brazil, January, 1929 (C. H. T. Townsend), in United States National Museum. Paratypes: Two females, Nova Teutonia, Brazil, latitude 27° 11′ S. and longitude 52° 23′ W., October 7, 1937 (Fritz Plaumann); Trancas, Argentina (H. L. Parker).

The margin of the lower calyptrae are darker in the paratypes.

This species is quite similar to *nigricosta,* but the unspotted wings and the longer antennae should serve to separate the two species.

Neomuscina nigricosta, new species

FEMALE: Length 7.0 mm. Head yellow, yellowish gray pruinescent, only the frontal triangle and back of the head to opposite middle of lower half of eyes dark. Front at vertex 0.28 of head width, parallel sided. With a complete row of inwardly directed parafrontal bristles, the posterior two pairs outwardly directed. Inner and outer verticals and anterior ocellar bristles subequal, well developed, postocellars smaller. Juncture of parafacials and parafrontals about 0.5 as long as width of the comparatively broad third antennal segment, parafacials virtually obliterated below. Cheeks 0.75 as high as width of third antennal segment. Facial ridges with several series of fine, hairlike setulae continued to opposite dorsal three-fourths of third antennal segment. Antennae, palpi, and proboscis fulvous, the last shiny. Antennae inserted opposite middle of eyes, descending to about level of lower margin. Third antennal segment 3.0 times as long as second. Arista with moderately long scattered hairs, the longest about as long as width of third antennal segment.

Thorax pale brownish fulvous with yellowish brown pruinescence, and four narrow, distinct, dorsocentral vittae. Dorsocentrals 2:4, the anterior two postsutural pairs more weakly developed; intra-alars 2; pra 0.5 as long as posterior notopleural bristle. Scutellar setulae descending to, but not onto, ventral surface except at basal lateral angles. Posterior thoracic spiracle without interspersed setulae; hypopleura with some pale hairs only above hind coxae.

Legs fulvous, the tibiae and tarsi brown. Fore femora normal. Fore tibiae with a very weak median anterodorsal bristle and apically with a subequal, anterior, posterodorsal, and posteroventral bristle. Mid femora with about four moderately well-developed bristles on basal half of ventral surface and with a pre-apical posterodorsal and posterior bristle. Mid tibiae with two to four posterior bristles. Hind femora with four or five well-developed anteroventral bristles on apical half and with several very much shorter ones on basal half of anteroventral and posteroventral surfaces. Hind tibiae with one anterodorsal and two shorter and weaker, anteroventral, median bristles.

Wings yellowish hyaline, with a very dark brown costal cloud which extends from apex of subcosta to apex of second vein and posteriorly to about middle of submarginal cell. Anterior and posterior cross veins broadly infuscated, the former subconfluent with costal cloud. Costal setulae and thorns scarcely developed. Posterior cross vein very slightly curved. Calyptrae fulvous hyaline, halteres concolorous with calyptrae, the base of knobs slightly darker.

Abdomen black, base of first and second visible tergites fulvous, the fulvous portion of second tergite broadly interrupted at center of a dark median vitta. With a row of weak discal bristles on apical tergite. Basal sternite setulose.

HOLOTYPE: Female, Port of Spain, Trinidad, Sepetmber 29, 1943 (F. M. Snyder).

Neomuscina transporta, new species

MALE: Length 5 mm. Head fulvous, grayish pruinescent, back of head from top to lower one-third dark. Front at narrowest part as wide as diameter of anterior ocellus. The parafrontals contiguous along most of their length. With about four or five pairs of fairly strong, inwardly directed, anterior, parafrontal bristles and three to five pairs of weaker, outwardly directed, posterior, parafrontal bristles. Juncture of parafacials and parafrontals about 0.5 as long as width of third antennal segment, the parafrontals narrowed to 0.5 the length of juncture below. Cheeks as high as width of third antennal segment. Setulae of facial ridges continued to opposite about the dorsal one-third of third antennal segment. Antennae inserted opposite lower 0.4 of eyes, fulvous yellow. Third antennal segment 2.7 times as long as second. Longest aristal hairs 1.25 to 1.50 times as long as width of third antennal segment. Palpi yellowish fulvous. Proboscis shiny fulvous brown.

Thorax fulvous, with sparse silvery pruinescence, with a trace of presutural darkened mid stripe which is more densely overlaid with pruinescence and with indications of two narrow vittae beside the dark mid area. Acrosticals 0:1; dorsocentrals 2:4; intra-alars 1; pra short but distinct. Scutellar setulae descending onto ventral surface of basal lateral angles. Hypopleura with hairs only above hind coxae. Posterior thoracic spiracle without interspersed simple setulae.

Legs fulvous, the tibiae more brownish fulvous. Fore femora normal. Fore tibiae without median bristles, but with the apical dorsal and posterodorsal bristle rather weak, the posteroventral one stronger. Mid femora with a row of about eight long, slender, ventral, hair-like bristles on basal one-half to one-third, with a pre-apical posterdorsal and posterior bristle. Hind femora with about eight anteroventral bristles which are rather hair-like towards base and become longer and stouter towards apex and with three or four posteroventral hair-like bristles on basal one-third to one-half which are about as long as femoral diameter. Hind tibiae with one strong and one weak, submedian, anterodorsal bristle, the weaker one towards apex and with three or four finer, median, anteroventral bristles.

Wings pale yellowish hyaline, with a brownish spot at apex of subcosta to first vein and a fainter one at apex of second vein. Both cross veins with a narrow faint cloud. Posterior cross vein moderately curved. Calyptrae and halteres pale.

Abdomen fulvous brown, apical portion of first to third tergites dark brown, the fourth entirely brown, all with grayish pruinescence. With a faint, dark, variable, dorsocentral vitta. Tergal bristles rather weak; a short lateral discal and lateral apical pair of bristles on third and a row of discal and apical bristles on fourth visible tergites. Basal sternite setulose; others with all bristles rather long, subequal, apicals not strongly differentiated.

FEMALE: Length 5 mm. Similar to the male. Front at vertex 0.28 of head width, parallel sided. The front brownish behind and becoming more fulvous anteriorly. With a row of five to six inwardly directed anterior and two outwardly directed, posterior, parafrontal bristles. Subapical parafrontal, anterior ocellar, inner and outer vertical bristles subequal; postocellar bristle about 0.5 as long. Thorax with the central darkened area extending farther postsuturally. The notopleural setulae adjacent to the anterior bristle less numerous. Intra-alars 2. Apical bristles on fore tibiae stronger, but the bristles on ventral surfaces of mid and hind femora shorter. Only the apical anteroventral bristles on hind femora as long as femoral diameter. Hind tibiae with a single, median, anterodorsal bristle. Abdomen with only the discal and apical row of bristles on fourth tergite distinct and upstanding, and even these are rather short.

TYPE MATERIAL: Holotype, male, and allotype, female, Stat. Accra, Africa, September 6, 1943 (M. A. Locke), No. A-660 43-17769 in United States National Museum.

I suspect that this species was taken from an aircraft which traveled from South America or was an importation via the same method. During almost 16 months of intermittent collecting in West Africa, including the vicinity of the airport at Accra, Gold Coast, no *Neomuscina* were collected, although many were taken in a shorter period of time in Central America and eastern South America.

The species has been keyed out twice because of the presence of a weak, apically situated, anterodorsal bristle on the hind tibiae in the holotype. The darker mid and hind femora and the thorax should separate *nudistigma* from *transporta* quite readily. In both sexes of *transporta,* the bristles on ventral surface of the hind femora are less numerous, weaker, and more widely spaced than in *nudistigma.*

Actually, *transporta* appears to be more closely allied to *nigricosta* and *fulvifrons.* Besides the characters mentioned in the key, the weaker abdominal bristles should help separate *transporta.* In *nigricosta,* the mid and hind tibiae are decidedly darker than in *transporta.*

Neomuscina nudistigma, new species

MALE: Length 5.5 mm. Head twice as high as long, brownish fulvous, grayish pruinescent. The back of the head to lower one-fourth of eyes black. Front at narrowest part 2.0 as wide as diameter of anterior ocellus Parafrontals subcontiguous, about as wide as diameter of anterior ocellus. Juncture of parafacials and parafrontals 0.5 as long as width of third antennal segment, slightly narrowed below. Cheeks as high as width of third antennal segment. With a complete row of parafrontal bristles, the ones that reach to beginning of the narrowest portion of front quite well developed, the posterior ones shorter and more hair-like. The anterior ocellar bristle and the most well-developed parafrontal bristles subequal; postocellars, inner and outer vertical bristles short and fine. Facial ridge setulae continued to opposite base of the arista. Eyes large, inner central area with slightly enlarged facets. Antennae fulvous, inserted opposite middle of eyes, descending to slightly above their lower level. Third antennal segment 2.3 times as long as second; arista plumose, the longest hairs slightly longer than greatest width of third antennal segment. Palpi fulvous, slightly wider towards apex. Proboscis shiny brownish black with very sparse pruinescence.

Thorax deep brown, grayish pruinescent. Humeri, apex of scutellum, propleura, and a variable portion of the postalar callosities yellowish brown. Thorax distinctly quadrivittate, the outer vittae wider than the inner ones and broadly interrupted at transverse suture. Acrosticals 0 : 1, sometimes some of the presutural acrostical setulae are slightly stronger than usual; dorsocentrals 2 :4, the anterior two pair slightly shorter than the posterior ones; intra-alars 2; pra absent. Scutellar setulae descending onto ventral surface except at apex. Hypopleura with a few setulae only above hind coxae. Anterior spiracular hairs yellow, those of posterior one more brownish; without interspersed simple setulae along margin of the latter.

Legs yellowish brown, the basal one-half to one-third of fore femora, basal half to three-fourths of mid femora and hind femora infuscated. Fore femora normal. Fore tibiae with a scarcely developed median anterodorsal bristle and with a strong, apical, dorsal, and posteroventral bristle and a somewhat weaker posterodorsal apical bristle. Mid femora with an almost complete row of posterior to posteroventral bristles, with a preapical posterodorsal and posterior bristle. Mid tibiae with three median posterior and a subapical posterior bristle. Hind femora with a complete row of strong, closely placed, anteroventral and posteroventral bristles. Hind tibiae with two median anterodorsal and three or four weaker anteroventral bristles.

Wings yellowish hyaline, with a very faint dark area extending from subcosta to apex of first vein and extending posteriorly to the latter vein. The cross veins with an indistinct cloud. Posterior cross vein almost straight. Costal setulae and thorns scarcely developed. Calyptrae hyaline; halteres pale brown, the base of knobs somewhat darker.

Abdomen brownish black, grayish pruinescent. The base of second, third, and fourth visible tergites with a small, sub-round central spot, the clothing setulae inserted in small dark spots. When viewed from the side, first, second, and third visible tergites with a dark apical margin. Third tergite with one or two lateral discal and apical bristles; fourth with an irregular row of subbasals, discals, and apicals. Basal sternite setulose, the others with well-developed apical bristles.

Female: Length 5.5 mm. Similar to the male, differing from it in having the front at vertex 0.3 of head width, the sides subparallel. Frontal vittae black, reddish at base of antennae.

With a complete row of parafrontal bristles and a few shorter setulae beside them, the strongest parafrontal, the anterior ocellar, inner, and outer vertical bristles subequal, the postocellars 0.5 as long and strong. Palpi more broadened throughout. Mid femora with the posteroventral bristle shorter and occupying the basal half to two-thirds. Hind femora with the ventral bristles shorter and only well developed at apex of anteroventral surface. Posterior cross vein more curved. The apical row of bristles on apical abdominal tergite not so long and strong.

TYPE MATERIAL: Holotype, male; allotype, female; and paratype, female; Caracas, Venezuela, May 23, 1943 (F. M. Snyder).

Neomuscina atincta, new species

MALE: Length 6 mm. Similar to *nudistigma.* Head more brownish. Front at narrowest part about as wide as diameter of anterior ocellus; parafrontals subcontiguous. In profile, juncture of parafacials and parafrontals only slightly longer than greatest diameter of arista, narrowed to 0.5 this width below. Anterior ocellar bristles not nearly so long and strong as the strongest parafrontal bristles. Third antennal segment 2.6 times as long as second.

Thorax as in *nudistigma,* the humeri and other parts of thorax less extensively fulvous.

Legs brownish yellow, the femora except apices black, the posterior four tibiae darker. Bristled as in *nudistigma,* but with the anteroventral bristles on hind femora less numerous and shorter towards base, and with only three or four posteroventral bristles at base.

Wings entirely hyaline. Abdomen less brownish.

FEMALE: Length 6 mm. Similar to the male, shaped and bristled as in female of *nudistigma,* but the front about 0.27 of head width. Hind femora with only two or three strong bristles towards apex of anteroventral surface.

TYPE MATERIAL: Holotype, male, Barro Colorado Island, Canal Zone, October, 1942 (J. Zetek); allotype, female, Higuito, San Mateo, Costa Rica (Pablo Schild); both in the United States National Museum.

Neomuscina nudinervis (Stein)

Cyrtoneurina nudinervis, STEIN, 1918, Ann. Hist. Nat. Mus. Natl. Hungarici, vol. 16, p. 226.

Neomuscina nudinervis, MALLOCH, Ann. Mag. Nat. Hist., ser. 9, vol. 16, p. 92.

MALE: Length 6 mm. Quite similar in general habitus and coloring to *nudistigma.* Head similarly colored. Front at narrowest not so wide as diameter of anterior ocellus. Parafacials and parafrontals at narrowest not so wide as greatest diameter of arista. At their juncture, the parafacials and parafrontals are 2.5 times as long as the greatest aristal diameter. The parafrontal bristles on apical half and the anterior and posterior ocellar bristles are subequal in length, and inner and outer vertical bristles are smaller. Palpi are not broadened.

Thorax colored and bristled as in *nudistigma,* but with a single pair of intra-alar bristles on each side, and the pra is short but distinct. Posterior spiracle not darker than the anterior one and with several setulae on the posteroventral corner.

Legs dark, only the apex of fore femora, basal half to two-thirds of fore tibiae with the apex of mid femora and apical fourth of hind femora fulvous to yellow. Mid femora with the ventral bristles fine on basal half and with a pre-apical dorsal, posterodorsal, and posterior bristle. Hind femora with the posteroventral bristles longer, more widely spaced, and confined to basal two-thirds. Hind tibiae with a single, median, anterodorsal bristle and a few more well-developed anterodorsal setulae basad to the strong median bristle.

The spot at apex of subcosta is slightly darker and distinct only to the apex of first wing vein.

Base of abdomen lighter in ground color and with the apical dark tergal marks broader and more distinct.

Otherwise as in *nudistigma.*

FEMALE: Length 6 mm. Similar to the male and to the female of the preceding species, differing from them in having the front at vertex 0.22 of head width, parallel sided. Only the post-ocellar bristles less well developed. Bristles on the basal one-third of posteroventral surface of hind femora are shorter. The apical row of bristles on fourth visible tergite undeveloped and the others much shorter than in the other species.

SPECIMENS EXAMINED: Eighty-one males and 74 females from Moca Guatalon, Guatemala; San Salvador, El Salvador; Higuito, San Mateo, Costa Rica; David, Barro Coloradò Island, Panama; Balboa, Panama Canal Zone; and Caracas, Venezuela.

Many of the specimens from Barro Colorado Island bear labels "Formes sp." and "bred from Polyporaceae."

Stein describes this species from a male in Bezzi's collection from Cordoba (Mexico?). Malloch records it from Demerara, British Guiana.

As in most species of *Neomuscina* having darkened clouds in the wings, teneral specimens lack the clouds or have them very faint and indistinct. In the above series, there are two specimens which have only two preapical bristles on the mid femora. They will run with difficulty to *mediana,* but may be readily separated from that species by the presence of black setulae among the flap-like covering of hairs of the posterior thoracic spiracle, as well as darker thoracic color.

Neomuscina nudinervis fulva, new subspecies

MALE: Length 5 mm. Anterior one-fourth of parafrontals, parafacials, and cheeks and peri-oral region yellow, grayish pruinescent, remainder of head black, grayish pruinescent. Front at narrowest part about as wide as diameter of anterior ocellus. The very narrowest part about as wide as diameter of anterior ocellus. The very narrow parafrontals narrowly contiguous. The parafrontal bristles longest on the noncontiguous portion and very short and directed forward on the posterior portion. Outer vertical, anterior, and posterior ocellar bristles weakly developed, inner verticals not distinguishable. Antennae inserted opposite middle of eyes, descending to opposite lower margin of eyes. Facial ridge setulae in a single series extending to about opposite middle of third antennal segment. Antennae and palpi yellowish. Longest aristal hairs about as long as the comparatively narrow third antennal segment. Proboscis brown, subshiny.

Thorax brownish fulvous, the disc distinctly darker brown, brownish gray pruinescent. Marked as in *similata* but with the lanceolate apical scutellar spot extending only to about the middle of scutellar disc. Bristled as in *nudinervis.*

Legs fulvous, bristled as in *nudinervis.* Fore tibiae with a very weak, median, anterodorsal setula. Hind femora with a complete row of strong anteroventral bristles and a row of posteroventral bristles on basal half.

Wings marked as in *nudinervis.*

Abdomen castaneous, grayish pruinescent, with an indistinct dark basal spot at center of second and third visible tergites. The clothing setulae inserted in shiny dark spots. With a few moderately well-developed, lateral, discal, and apical bristles on third visible tergite and with a complete row of discal and weaker apical bristles on apical tergite. Basal sternite setulose, others, except fifth, with moderately developed apical bristles.

FEMALE: Length 6.5 mm. Similar to the male, differing from it in having the head as in *nigricosta*. Thorax with a pair of intra-alar bristles on each side. Legs as in male, but the anteroventral and posteroventral bristles on hind femora weaker, nevertheless well developed. Only the discal row of bristles on the apical tergite well developed, the other abdominal tergal bristles much weaker.

TYPE MATERIAL: Holotype, male, and allotype, female, Villarica, Paraguay, July, 1937 (F. Schade). Paratypes: Two males and one female, topotypical; one male, Rio de Janiero, Brazil, November 24, 1933 (H. Souza-Lopes); one female, Nova Teutonia, Brazil, latitude 27° 11′ S. and longitude 52° 23′ W., April 6, and one male, April 14, 1939 (Fritz Plaumann).

Neomuscina instabilis, new species

MALE: Length 5 mm. Head 2.25 times as high as long, fulvous, brownish gray pruinescent. Back of head to lower level of eyes blackish, grayish pruinescent. Front at narrowest part as wide as diameter of anterior ocellus. The parafrontals contiguous at middle. In profile, juncture of parafacials and parafrontals about 0.5 as long as width of third antennal segment, the parafacials narrowed below. Cheeks as high as width of third antennal segment; a row of five to seven parafrontal bristles of moderate length which are continued to beginning of the narrowest portion of front, the remainder of the parafrontals with a row of very short setulae which are about half as long as the smallest anterior group of parafrontals. Inner and outer vertical and the anterior and posterior ocellar bristles short, subequal. Facial ridges with the very short setulae inserted to about level of aristal insertion. Antennae fulvous, the apical portion of third segment occasionally slightly darker. Antennae inserted opposite center of eyes, extending to slightly below the lower level of eyes. Third antennal segment 3.0 times as long as second. Longest aristal hairs as long as width of third antennal segment. Palpi yellowish, slightly infuscated on basal one-fourth; proboscis brownish black, shiny.

Thorax black, yellowish gray pruinescent. Humeri and apex of scutellum with a variable portion of postalar callosity brownish fulvous. Disc with two narrow brown vittae which extend from anterior part of thorax to about opposite the second postsutural dorsocentral and two broader lateral vittae, broadly interrupted at the suture, which extend to level of posterior intra-alar bristle. Dorsocentrals 2:4, anterior two postsutural dorsocentral bristles somewhat shorter than the posterior two; intra-alars 1; pra minute or absent. Scutellar setulae descending onto ventral surface only at base. Hypopleura with setulae only above base of hind coxae; without setulae among the flap-like covering of hairs of the posterior thoracic spiracle.

Apices of femora and tibiae fulvous to fulvous brown, remainder of legs brown to brownish black. Fore femora normal. Fore tibiae with or without a very weak, scarcely distinguishable, median, anterodorsal setula, the apical dorsal and posteroventral bristles equal, stronger than the moderately well-developed posterodorsal bristle Mid femora with a row of three to five ventral to posteroventral bristles on basal half, and with a preapical dorsal posterodorsal and posterior bristle. Mid tibiae with two to four posterior bristles. Hind femora with a complete row of anteroventral bristles and a row of posteroventral bristles on basal half to two-thirds. Hind tibiae with one median anterodorsal, and two or three weaker anteroventral bristles.

Wings very pale brownish hyaline. Cross veins not infuscated. Posterior cross vein almost straight, costal setulae and thorns scarcely developed. Calyptrae hyaline, margins slightly yellowish. Halteres yellow.

Abdomen dark brown to black except the basal portion of first visible tergite which is yellow to fulvous. Apices of first to third tergites with a dark transverse band and with a median spot on second and third tergites; the spot on second subconfluent with the apical band. Frequently with a grayish pruinescent patch at juncture of spot and band. The clothing setulae inserted in dark spots surrounded by dense grayish pruinescence; with two to four lateral apical bristles on third visible tergite and a complete row of subbasal, discal, and apical bristles on fourth segment, the latter weakest. Basal sternite setulose, others with moderately developed apical bristles.

FEMALE: Length 5.5 to 6.5 mm. Similar to the male. Front black, fulvous at base of antennae; at vertex front 0.25 of head width, parallel sided. With a complete row of alternating weak and strong parafrontal bristles and with some very weak setulose hairs laterad to them. The stronger parafrontal, anterior ocellar, inner and outer vertical bristles subequal; the postocellars shorter and finer. The darker portions of the palpi and third antennal segment more distinct; the palpi slightly broader. Thorax with fulvous portion more extensive, especially at humeri. Intra-alars 2. Legs darker colored. The apical lateral bristles on third abdominal tergite and the apical row on the fourth are scarcely developed.

TYPE MATERIAL: Holotype, male, and allotype, female, David, Republic of Panama, August 29, 1943. Paratypes: Thirteen males and nine females, topotypical; one male and one female, Balboa, Panama Canal Zone, June 12, 1943; two males and three females, Port of Spain, Trinidad, September 29, 1943; one male and one female, May 14, one male, February 5 to 24, 1943, Natal, Brazil. (All F. M. Snyder.)

Additional specimens in rather poor condition seen from Barro Colorado Island, Tabernilla, and El Cermeno, Panama.

It is possible that this species is *stabilis* Stein (1911, p. 86) which I have not seen. Until the type can be examined, I have considered the above described species distinct on the basis of lighter colored legs, more numerous bristles on the mid tibiae and on the anteroventral and posteroventral surfaces of hind femora.

Neomuscina schadei, new species

MALE: Length 5 to 5.5 mm. Very similar in structure to *instabilis*. The anterior parafrontal bristles are usually four to six in number. Parafrontals are very narrowly separated along their entire length.

Thorax fulvous brown, grayish yellow pruinescent, the humeri and scutellum practically concolorous with disc. With four brown longitudinal vittae. Bristled as in *instabilis* but with intra-alars 2.

Legs entirely fulvous, occasional specimens with slight brownish tinge towards base of posterior femora.

Abdomen as in *instabilis*, but ground color is more fulvous brown.

FEMALE: Length 5 to 5.75 mm. Similar to the male, differs in having front at vertex 0.25 of head width, parallel sided. Colored and bristled as in female of *instabilis*, but third antennal segment not so distinctly darkened apically. With two intra-alar bristles. Legs with the femora slightly more brownish.

TYPE MATERIAL: Holotype, male; allotype, female; paratypes, 12 males and nine females; all Villarica, Paraguay, June, 1937 (F. Schade).

Stein described *Mydaea dorsipunctata* (Stein, 1918, p. 215) from several females from Oxaca and Tapachula, Mexico, in Bezzi's collection. *Schadei* agrees with it in many respects, but until the type can be examined the two species are considered as distinct, mainly upon geographical distribution.

Neomuscina similata, new species

FEMALE: Length 6 mm. Very similar to *nigricosta*, differing from it in having the frontal vitta black, except at the extreme apex; back of the head to almost lower margin of eyes black, grayish pruinescent; the proboscis shiny blackish brown.

Thorax as in *nigricosta* but with the vittae broader, darker and the median pair of vittae extending onto the scutellum as a pair of subshiny triangular marks, so that there appears to be a long, lanceolate yellow spot from apex to the base of scutellum.

Legs infuscated, the coxae, apical half of fore femora, and apices of mid and hind femora fulvous. Bristled as in *nigricosta* except that the mid femora has a pre-apical dorsal bristle in addition to the usual pre-apical posterior and posterodorsal one; hind femora with the basal anteroventral and posteroventral bristles more well developed and hind tibiae with three median anteroventral bristles.

Wings with the costal cloud reduced to a darkened area at apex of first wing vein and entirely enclosed within the marginal cell and another less extensive one at apex of second vein. Cross veins distinctly infuscated.

Base of abdomen with the fulvous spots replaced by smaller, indistinct brownish areas.

TYPE MATERIAL: Holotype, female, Port of Spain, Trinidad, September 29, 1943 (F. M. Snyder); paratypes: one female, topotypical; two females, Caracas, Venezuela, May 23, 1943 (F. M. Snyder), and Quebrada Secca, Venezuela.

Neomuscina neosimilis, new species

MALE: Length 6 mm. long. Head yellow, grayish pruinescent, cheeks brownish and back of head from top to lower one-fourth darkened. Front at narrowest part as wide as diameter of anterior ocellus. The parafrontals contiguous, the frontal vitta is reduced to a triangular portion beyond ocelli and at base of antennae. With about four pairs of anterior and six to eight pairs of posterior parafrontal bristles, the latter forwardly directed. Anterior ocellar, inner and outer vertical bristles subequal, 0.75 as long as the strong pair of pre-apical parafrontal bristles. In profile, juncture of parafacials and parafrontals 0.33 as long as width of third antennal segment, slightly narrowed below. Setulae on facial ridges continued to opposite insertion of arista. Antennae yellow, apex slightly fulvous; third segment 2.6 times as long as second. Longest aristal hairs as long as width of third antennal segment. Palpi pale yellow. Proboscis brown, lighter towards apex.

Thorax brownish fulvous, yellowish white pruinescent, with four distinct vittae. Pleura and apex of scutellum fulvous. Dorsocentrals 2:4; pra very short; notopleura with only one or two setulae adjacent to the anterior bristle. Scutellar setulae descending onto ventral surface at basal lateral angles; intra-alars 1; hypopleura with hairs in front of spiracle and above hind coxae. Posterior thoracic spiracle without interspersed simple setulae.

Legs fulvous. Fore femora normal. Fore tibiae with a weak median anterodorsal bristle, the apical dorsal, posterodorsal, and posteroventral one strong, of the three the posterodorsal bristle is shortest. Mid femora with about six ventral bristles on basal half and with a pre-apical dorsal, posterodorsal, and posterior bristle. Hind femora with a complete row of anteroventral bristles and a row of posteroventral ones on basal one-half to two-thirds. Hind tibiae with one median anterodorsal and three anteroventral bristles; the setulae along anterodorsal surface slightly longer and more hair-like.

Wings hyaline, with a spot at apex of subcosta which is subconfluent with the cloud around anterior cross vein and another around the slightly curved posterior cross vein. Calyptrae white. Halteres pale.

Basal two visible abdominal segments fulvous, others dark brown to black, bluish gray pruinescent; with an indistinct apical dark band on first two tergites and with a dark central basal spot on second and third tergite, the spot on third tergite scarcely distinguishable. Fourth tergite with about three discal and apical bristles and with a row of discal, subapical, and apical bristles. Basal sternite setulose.

FEMALE: Length 6 mm. Similar to the male. Front at vertex 0.31 of head width, narrowed anteriorly to 0.26. Frontal vitta fulvous on anterior one-third, dark behind. With a complete row of strong parafrontal bristles.

Thoracic dorsum more fulvous and with less dense pruinescence. Intra-alars 2. Mid tibiae with two to three posterior bristles and the anteroventral and posteroventral bristles on hind tibiae more widely spaced. Third abdominal tergite without lateral discal bristles.

TYPE MATERIAL: Holotype, male, Nova Teutonia, Brazil, latitude 27° 11′ S., longitude 52° 23′ W., June 4, 1939 (Fritz Plaumann); allotype, female, Villarica, Paraguay, July, 1937 (F. Schade); paratype, one female, same data as allotype.

Neomuscina currani, new species

MALE: Length 5.5 mm. Head yellow, silvery pruinescent; cheeks slightly orange, and back of head from top to lower two-thirds darkened. Front at narrowest part not quite so wide as diameter of anterior ocellus. Parafrontals contiguous on 0.5 their length. In profile, only the juncture of parafacials and parafrontals visible, and only as long as greatest aristal diameter. With three or four pairs of anterior parafrontal bristles, only the subapical one well developed. The remainder of parafrontals with about seven pairs of forwardly directed bristles, which are as long as the length of the anterior ocellar bristles and the parafrontal bristles except the strong subapical pair. Cheeks almost as high as width of third antennal segment. Facial ridges with pale, scarcely visible hairs to opposite middle of third antennal segment. Antennae pale yellow, inserted opposite lower 0.4 of eyes, extending to opposite their lower level. Third antennal segment 2.25 times as long as second. Longest aristal hairs as long as width of third antennal segment. Palpi pale yellow. Proboscis shiny light brown.

Thorax fulvous brown, humeri slightly and apex of scutellum lighter colored, densely grayish pruinescent, presuturally with two narrow brown vittae and postsuturally with four, the broader lateral pair narrowly join a prescutellar median pair. Dorsocentrals 2:3; intra-alars 2; pra 0.5 as long as posterior notopleural bristle; scutellar setulae descending onto ventral surface at basal lateral angles. Hypopleura haired in front of spiracle and above hind coxae. Posterior thoracic spiracle without interspersed simple setulae.

Fore legs fulvous, mid and hind legs brown. Fore femora normal. Fore tibiae with a very short, median, anterodorsal setula, apically with one strong dorsal and posteroventral bristle, the apical posterodorsal bristle much reduced, scarcely distinguishable from the clothing setulae. Mid femora with one or two small, median, anterior, bristle-like setulae, a row of fine, ventral bristles on basal half and with one pre-apical dorsal, posterodorsal, and posterior bristle. Mid tibiae with two strong median posterior bristles and two or three much shorter ones on apical one-fourth. Hind femora with three moderately strong, anteroventral bristles on apical one-third and some shorter and finer ones on basal two-thirds, with two or three fine setulae on basal one-third of posteroventral surface, only the apical anteroventral bristles are as long as femoral diameter. Hind tibiae with two anterodorsal and three anteroventral bristles near middle.

Wings pale brownish hyaline. With distinct clouds over both cross veins and another from apex of subcosta to apex of second vein posteriorly to second vein. Third vein with a single setula on ventral surface beyond node. The fourth vein a little more gently curved than in other species. Calyptrae yellowish white; halteres yellow.

Abdomen as in *macrops* except the base of first and second visible tergites are slightly fulvous. The tergal bristles weaker.

FEMALE: Length 5.5 mm. Similar to the male. Front at vertex 0.27 of head width, parallel sided, with a row of five strong, parafrontal bristles, the posterior two pairs backwardly and outwardly directed. Front black, fulvous only at base of antennae. Third antennal segment slightly darkened apically. Thorax more uniformly quadrivittate. The apical posterodorsal bristle on fore tibiae well developed. Ventral bristles on mid femora and the apical anteroventral bristles of hind femora stronger, while the basal anteroventral bristles of hind femora are much weaker. The curvature of the fourth wing vein is more abrupt. The fulvous color of the abdomen is limited to a very small area on basal tergite.

TYPE MATERIAL: Holotype, male, Barro Colorado Island, February 19, 1929 (C. H. Curran); allotype, female, topotypical, February 21, 1929 (C. H. Curran).

This species appears to be midway between the typical *Neomuscina* and *Spilopteromyia*, as illustrated by the single setula on the ventral surface of the third wing vein.

Neomuscina (Spilopteromyia) apicata (Stein)

Spilogaster apicata STEIN, 1904, Ann. Hist. Nat. Mus. Natl. Hungarici, vol. 2, p. 422.

Spilopteromyia apicata, MALLOCH, 1921, Ann. Mag. Nat. Hist., ser. 9, vol. 8, p. 442.

This species from Vilcanota, Peru, was described from a female in the Budapest Museum. Malloch recorded it from Colombia when he made it the genotype of *Spilopteromyia;* his specimens are deposited in the British Museum (Natural History). I have not seen these specimens nor any other which I consider to be conspecific. Dr. van Emden kindly communicated the fact that Malloch's specimens have one setula above and below on juncture of first and second wing veins; minute hairs on the subtriangular portion of hypopleura above hind coxae; and an anterodorsal, dorsal, posterodorsal, and posterior pre-apical mid femoral bristle.

Stein states that the front at base of the antennae is quite narrow for a female, being at most two-thirds as wide as the eye. The antennae and palpi are yellow. Dorsocentrals are 2:4; acrosticals 0:1; pra very short. The legs are blackish brown, the tips of the femora below are yellowish. The hind tibiae have one anterodorsal and two to three anteroventral bristles. The costal area of the wing to the tip except for a small clear space beyond first vein is brown and the cross veins are broadly infuscated. The calyptrae are white and the halteres are yellow. The species is 7.5 to 8 mm. long.

Neomuscina (Spilopteromyia) atincticosta, new species

MALE: Length 5.5 to 6 mm. Head yellow, brownish yellow pruinescent. Front at narrowest point not wider than distance across posterior ocelli inclusive. Parafrontals contiguous; with a complete row of parafrontal bristles extending to opposite anterior ocellus. The anterior pair of parafrontal bristles only slightly longer than others and about as long as the anterior ocellar bristles, not so robust as the vibrissae. Inner and outer verticals not longer than other parafrontal bristles. Juncture of parafacials and parafrontals not so long as width of third antennal segment, narrowed below. Cheeks 1.5 as high as width of third antennal segment, narrowed below. Facial ridges with a single row of short, fine setulae reaching to slightly below aristal insertion. Palpi yellow. Antennae yellow, inserted at slightly below middle of eye, reaching almost to lower margin of eye. Third joint 2.25 times as long as second, longest aristal hairs as long as width of third antennal segment.

Thorax fulvous, with grayish pruinescence. Dorsocentrals 2:4; acrosticals 0:1; intra-alars 2; pra as long as posterior notopleural bristle. Scutellar setulae descending onto ventral surface. Propleural and stigmatal bristles weakly duplicated. Sternopleurals 1:2 or 1:3.

Legs fulvous. Fore femora normal. Fore tibiae bare at middle. Mid femora with a row of ventral bristles on basal half, with a pre-apical dorsal, posterodorsal, and posterior bristle. Mid tibiae with three median posterior bristles. Hind femora with a complete row of long, fine, anteroventral and a row of posteroventral bristles on basal half. Hind tibiae with one median anterodorsal and three finer anteroventral bristles.

Wings hyaline, slightly yellowish at base, anterior cross vein only infuscated. Costal thorn and setulae scarcely developed. Posterior cross vein gently curved. Third vein with several setulae beyond node on ventral surface. Calyptrae hyaline with deep brown margins. Halteres yellow.

Abdomen fulvous, grayish pruinescent, the apical segments darker bluish brown. With an indistinct darker dorsocentral vitta. All setulae inserted in darker spots. One or two pairs of well-developed lateral apical bristles on second and third visible tergites and with a row of strong discal and apical bristles on apical tergite. Basal sternite setulose. Fifth sternite moderately cleft.

TYPE MATERIAL: Holotype, male, and paratype, male, Nova Teutonia, Brazil, latitude 27° 11′ S., longitude 52° 23′ W., July 5, 1939 (Fritz Plaumann).

Neomuscina (Spilopteromyia) tinctinervis (Stein)

Mydaea tinctinervis STEIN, 1918, Ann. Hist. Nat. Mus. Natl. Hungarici, vol. 16, p. 220.

I am uncertain whether this species, which was described from Santa Catharina and São Paulo, Brazil, belongs in this segregate. Stein mentions that the third wing vein has short setulae at the base, but does not state whether they are on the dorsal or ventral surface or both. He compares it with *inflexa*, which, if I have identified it correctly, belongs to *Neomuscina*, *sensu stricto*.

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AMERICAN MUSEUM NOVITATES

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CITY OF NEW YORK FEBRUARY 2, 1949 NUMBER 1405

THE IDENTITY OF *APHELORIA CORIACEA* (DIPLOPODA, XYSTODESMIDAE)

By Richard L. Hoffman[1]

The precise identity of the milliped *Apheloria coriacea* (Koch) has apparently never been satisfactorily established. In fact there is evidence that some recent writers have applied the name to at least two different species. This confusion is due largely to the fact that no usable description of the species has been published, and the male gonopods, which provide the most reliable diagnostic features, have not been illustrated.

Since the time of the original description of the species in 1847, the name *coriacea* has been generally accepted by milliped workers. Two notable exceptions obtain in Dr. H. C. Wood and Dr. Carl Attems, both of whom seem to have overlooked the description of the species. Attems' recent monograph of the polydesmoid diplopods (1937–1939) includes *A. corrugata* (Wood), a name which was shown by Bollman to be a synonym of *coriacea* as long ago as 1888.

The purpose of the present paper is to provide a detailed description of the species, as well as to illustrate the male and female gonopods.

From the original description, little information of diagnostic value can be gathered beyond the size and color pattern, but fortunately a type locality is mentioned—"*Virginien.*" There is only one known xystodesmid in Virginia (and near-by states) to which Koch's description could apply. It seems reasonable to assume that the original types were collected in eastern Virginia, where so far only this one xystodesmid has been found. The types of *coriacea* are apparently lost, and neotypes are herein designated to form the basis of the following descriptions.

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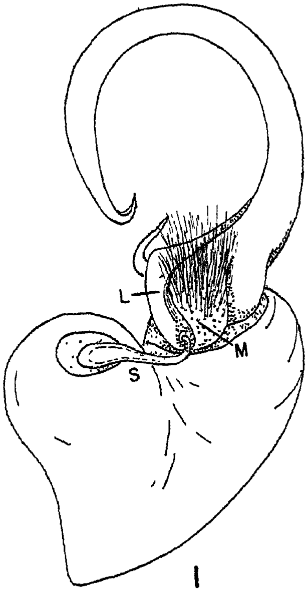
[1] Miller School of Biology, University of Virginia, Charlottesville



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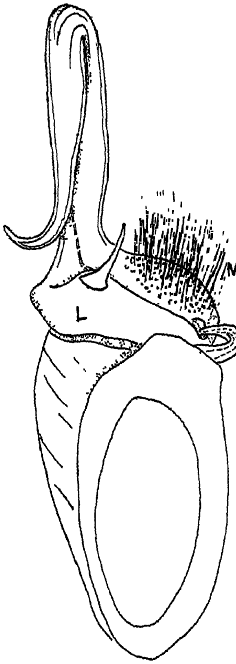

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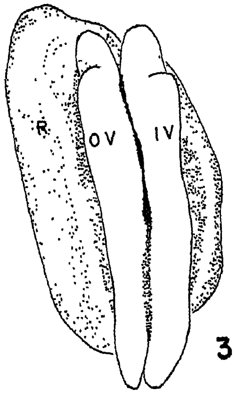

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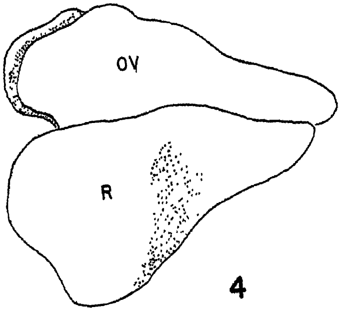

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FIG. 1. *Apheloria coriacea*, left gonopod of male, mesial aspect. *Abbreviations:* L, lateral process; M, mesial process; S, solenite.

FIG. 2. Left gonopod of male, cephalic aspect, abbreviations as in figure 1.

FIG. 3. Left gynopod of female, distal aspect. *Abbreviations:* R, receptacle; OV, outer valve, IV, inner valve.

FIG. 4. Left gynopod, lateral aspect, abbreviations as in figure 3.

A thorough treatment of the genus *Apheloria* is now in preparation but will not be completed for some time; hence the present information is published separately for the benefit of other workers.

APHELORIA CHAMBERLIN

Apheloria Chamberlin, 1921, Canadian Ent., vol. 53, p. 231 (*Fontaria montana* Bollman, generotype).

Apheloria coriacea (Koch)

Figures 1–4

Fontaria coriacea Koch, 1847, System der Myriapoden, p. 141.

Polydesmus (*Fontaria*) *corrugatus* Wood, 1864, Proc. Acad. Nat. Sci. Philadelphia, p. 7.

Type Locality: "*Virginien*," here restricted to Swann's Point Plantation, 6 miles north of Surry Court House, Surry County, Virginia; across the James River from Jamestown Island.

Type Specimens: Neoholotype male and neallotype female deposited in the collection of the American Museum of Natural History; a neoparatype male in the United States National Museum, No. 1832; and one in the writer's collection, No. 15; all were collected on April 20, 1947, by R. L. Hoffman and J. P. E. Morrison.

Diagnosis: A large member of the genus, characterized by the color pattern and by the configuration of the gonopods. The dorsum blackish with keels red and posterior margins of tergites yellow; lateral process of telopodite of male gonopod represented by a slightly elevated transverse ridge across the cephalic portion of the base, bearing a slender, curved, mesocaudally directed spine; distal end of telopodite blade curved laterad.

Description of Neoholotype: Body robust, length 39, width 9.5 mm.; sides subparallel, segments 5 through 15 of nearly full width; body tapering abruptly cephalad, more gradually caudad. Tergites well arched, keels wide, continuing slope of dorsum.

Collum crescentic in dorsal aspect, caudolateral edges tapering cephalad; lateral marginal ridges distinct.

Segments 2 through 4 subsimilar, caudal margin of tergites straight, caudal edges of keels swept forward, smoothly rounded; marginal thickenings present but poorly defined.

Segments 5 through 15 generally similar, caudal margins of keels slightly produced caudad, caudolateral corners of keels produced into small pointed lobes; sides of keels smooth, rounded; cephalolateral corners broadly rounded. Dorsal marginal thickenings very prominent, smooth in contrast to the granular upper surface of the keel and strikingly coriaceous dorsum. Suture between prozonites and metazonites prominent, surface of former smooth.

Segments posterior to twelfth agree with those preceding, but with keels becoming increasingly produced caudad, and entire segments becoming narrower; keels of nineteenth are largely elongated, broadly oval lobes which are longer than the tergite at midline.

Anal segment triangular in dorsal aspect, tip slightly truncated, two subterminal lateral setiferous tubercules. Anal valves inflated, very smooth, the setiferous tubercules almost obsolete; mesial ridges very prominent. Pre-anal scale broadly triangular.

Bases of last pair of legs in contact. All sternites smooth, glabrous, not produced noticeably at the bases of the legs; those between the third, fourth, and fifth pairs of legs with small, rounded lobes. Prefemora and femora bearing large sharp spines. Terminal tarsal joint equal to proximal two, much shorter than femur; tarsi sparingly hirsute.

Gonopods protruding from a large ovoid aperture. At rest, the appendages are retracted snugly against the sternites and the telopodite blades lie together, often interlocked. When in use, the gonopods are protruded so that the axes of the telopodite coil are parallel with the median axis of the body with the distal end of the blade cephalad. Directions referred to in connection with the gonopods are derived from the appendage in this position.

Mesial process a large, rounded, very setiferous shoulder. Lateral process represented by a conspicuous, flattened, mesially elevated ridge projecting obliquely transverse across the cephalic portion of the gonopod, bearing a long, slender, mesocaudally directed spine just below its highest portion. Blade of telopodite bent into a nearly complete circle, in one plane except the distal eighth, which is bent laterad. A conspicuous groove between the lateral and mesial processes, commencing at the inner termination of the former and continuing up the lateral edge of the telopodite blade. At the base of the lateral process is a deep depression, this connected by the "solenite"[1] to the coxal joint of the appendage. For details of the gonopods, consult figures 1 and 2, from which some of the setae have been omitted in the interests of clarity.

Second pair of legs with the usual cylindrical, distally truncate seminal lobes. Pregenital limbs more hairy than the postgenital, their femora without spines.

Color (from living specimen) as follows: Tergites glossy dark brown, almost black, caudolateral portions of keels rose pink, posterior margins of tergites with bright, lemon yellow cross bands which touch the reddish keels without grading into them. Head tan in front, antennae somewhat darker. Under parts in general yellowish tan, sternites slightly darker.

DESCRIPTION OF NEALLOTYPE: Agreeing in most respects with the male; differing in the following respects: body broader, more compact, tergites more arched, marginal ridges of keels not especially distinct and upper surface of keel not different in texture from rest of dorsum. Length 35.5, width 8.6 mm.

Gynopods[2] relatively large, composed of the following parts: an irregularly shaped, box-like receptacle, somewhat triangular in lateral aspect and longer than high; containing a retractable pair of long, slender, opposable valves, hinged at the cephalic end and capable of being withdrawn into the base. These parts are strongly chitinous and situated on the end of a protrusible sac of sclerotized tissue. The gynopods are shown in figures 3 and 4.

Color pattern similar to that of the male, but cross bands wider and expanded at midline into small, semicircular yellow spots.

RANGE: Exact limits of the range are not yet known with certainty. Specimens have been examined from Virginia, Maryland, Pennsylvania, New York, Ohio, West Virginia, and Indiana. Various literature references (not wholly trustworthy) report the species from North Carolina and Kentucky, in the south, and Michigan in the north. Numerous range extensions and refinements can be expected in the future following additional field work.

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[1] The "hufthornchen" of German workers. The term "solenite" is here tentatively employed pending refinement of a better terminology.

[2] A term tentatively used instead of the customary "vulvae" It is felt that "vulvae" should apply strictly only to the parts herein referred to as "valves" and that the term "gynopod" is a somewhat more meaningful one.

REMARKS: Judging from the large number of specimens that have found their way to museum collections, *coriacea* must be the commonest member of the genus. The color pattern is almost diagnostic in itself, but is approximated in a few other eastern xystodesmids in *Apheloria* and other genera.

It should be mentioned here that bleached museum specimens cannot at present be infallibly determined as *coriacea*. Certain other members of the genus possess gonopods which are almost identical, and distinctions can be made only on the basis of color pattern. Some of these forms are *A. montana* (Bollman), *roanea* Chamberlin, and *tigana* Chamberlin.

ACKNOWLEDGMENTS

A number of persons have kindly extended courtesies and assistance which greatly facilitated preparation of this paper. I am much indebted to Mr. Garland Gray of Waverly, Virginia, for the opportunity of spending several days at Swann's Point Plantation; to Miss Mathilde M. Carpenter of the United States National Museum and Prof. R. V. Chamberlin of the University of Utah for assistance with literature references; and to Dr. Horton H. Hobbs, Jr., of the University of Virginia for providing facilities for work and for checking the manuscript.

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NOTES ON SOME PLOCEIDAE FROM WESTERN ASIA[1]

BY CHARLES VAURIE

INTRODUCTION

In 1937 the American Museum of Natural History began to receive from Dr. Walter Koelz very large series of birds collected during his travels in various parts of India, Afghanistan, and Persia. So far, some 25,000 skins have been received, the earliest ones dating from the end of 1936 and the most recent ones from the end of November, 1947. The size of this collection is remarkable and speaks highly for the industry of Dr. Koelz, particularly when one considers that during this time he was engaged in other pursuits, notably the collecting of botanical specimens.

Dr. Koelz has very generously offered to the workers of the American Museum the privilege of studying this magnificent lot of fresh material. The results will be published in a series of reports, of which this is the first. The customary itinerary is omitted as some of its details remain to be checked.

I appreciate the opportunity given by Dr. Koelz to work on his great collection. I have received much friendly help in every way from Dr. Ernst Mayr and I am deeply grateful for his advice and interest in this study. I am also grateful to Mr. Jean Delacour and Dr. James P. Chapin for valuable suggestions.

THE GENUS *PETRONIA*

Despite the fact that various authors have in the past, at one time or another, merged *Gymnoris* and *Carpospiza* under *Pe-*

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[1] Notes from the Walter Koelz Collections, Number 1.

tronia, Hartert, although admitting that *Gymnoris* was not actually very distinct from *Petronia* and could very easily be merged with it, has continued, as well as some later authors, to observe the separation of the Rock Sparrows into the three genera, two of which, *Petronia* and *Carpospiza*, are monotypic.

Carpospiza is intermediate in every way between *Petronia* and *Gymnoris*. That is perhaps best shown by the shape of the bill, but there are other points of similarity such as the presence in *Carpospiza* of white tips on the tail feathers as in *Petronia*. The difference between the shape of the bill of *Carpospiza* and that of *Gymnoris* is not very great, and the general body coloration can be identical in females of *Carpospiza* and *Gymnoris*. We have adult females of the western race of *Gymnoris* (*occidentalis*) that match perfectly the pale sandy color of female *Carpospiza*. These specimens lack the yellow throat patch, and the trace of rust on the lesser wing coverts is so faint that actually the best difference is not so much the shape of the bill as the lack in *Gymnoris* of the white tips on the tail feathers.

All these sparrows, furthermore, have similar habits, and the differences between *Petronia*, *Gymnoris*, and *Carpospiza* can be considered no more than specific. I therefore synonymize *Gymnoris* and *Carpospiza* with *Petronia*.

PETRONIA PETRONIA

Two races of this sparrow are found in Persia. One occupies the northern mountains from Azerbaijan into the Elburz, and the other the more southern mountains in the rest of Persia from Kermanshah and Luristan on the west, through central and southern Persia, to Khorasan on the east, this same race continuing into and through Afghanistan to Kashmir.

The more northern race is *Petronia p. exigua* Hellmayr, 1902. This race, originally described from the region of the Caucasus to Rostov on the Don in the west, was said to differ from the nominate race, *P. p. petronia* Linnaeus, 1766 (type locality, northern Italy, as fixed by Hartert, 1910), by being less earth brown above, more dusty gray, and by having the stripes on top of the head paler and less distinct, and also by having a little more powerful bill.

The more southern and eastern race, *P. p. intermedia* Hartert, 1901 (type locality, Gilgit, Kashmir), was said by its author to range from Kashmir to Kandahar, Afghanistan, and to be lighter, larger, and with stripes more indistinct than in *P. p. petronia.*

No specimens from the Caucasus are available for examination; our only three specimens from the range of *exigua* are three adult males collected at Livan, Azerbaijan, on November 17 and 18. When these are compared to two typical specimens of *P. p. petronia* collected in northern Italy on November 20 and 30, the birds of Azerbaijan are not earth brown but dull grayish brown and have much less distinct stripes on top of the head.

When these November specimens are compared to specimens collected in Afghanistan (*P. p. intermedia*) from September 30 to October 12, and to a series from Luristan in western Persia collected from October 25 to November 11, the birds of Afghanistan are seen to be definitely more tawny, less gray than those of Azerbaijan. Those from western Persia, though perhaps very slightly grayer, are, on the whole, indistinguishable from those of Afghanistan. Two late September (26 and 27) specimens from Khorasan in eastern Persia are exactly similar to the specimens from Afghanistan.

All these fall specimens have just completed the moult and are in very fresh plumage. By the middle of January the birds in our series already show a considerable amount of wear resulting in a significant change in coloration. The plumage is no longer so tawny, but duller and grayer. Examination shows that the type of *intermedia*, as well as two paratypes (January 9–13), is similar to other January specimens from Luristan, though the slight difference existing in the fresh plumage still holds, these latter being very slightly grayer. Unfortunately I have no specimens of *exigua* available from this period, but a similar wearing down and darkening of the plumage must probably occur in this race.

From this period, December 30 to February 12, I have a large series from Iran and Kirman in central and southeastern central Persia. All these birds are grayish and dull. It is possible that some are migrant *exigua* from farther north, but lacking comparative specimens of *exigua* I can only say that as a series they are indistinguishable from the January specimens from Luristan, though a few average a little grayer.

Later on in the season, from the middle of March through April and May, and later, the plumage continues to wear, and, losing its grayish cast, becomes a bleached, burned-out brown.

The only comparative specimens that I have from this season are some from Luristan, two from Fars in southern central Persia, and one from Afghanistan. The birds from these three regions are on the whole similar, but the birds of Fars average a little grayer.

Throughout all these seasons, early fall to May, typical *P. p. petronia* from northern Italy is darker and more earth brown in all plumages.

The discrimination between all the various populations of *P. petronia* found in Persia, Afghanistan, and Kashmir must then take into consideration two factors, that of the progressive wear of the plumage and that of geographical distribution. In fresh fall plumage the difference between *P. p. exigua* and *P. p. intermedia* is well marked. The birds of northern Persia (*exigua*) are dull gray brown; those from Kashmir, Afghanistan, Khorasan, and Luristan are tawny brown.

I lack worn specimens of *exigua* and fresh specimens from central, southeastern central, and south central Persia, but in view of the fact that birds in worn plumage from these regions are as a series very close to, or indistinguishable from, those of

MEASUREMENTS OF ADULT MALES

Races and Locality	No.	Wing	Tail	Bill
P. p. petronia Northern Italy	8	93.0–100.0 (95.75)	48.0–54.0 (50.70)	14.0–16.0 (14.94)
P. p. exigua				
Azerbaijan	3	100.5–104.0 (102.83)	53.0–55.0 (54.33)	15.0–16.0 (15.50)
P. p. intermedia				
Western Persia[a]	12	99.0–105.0 (101.60)	50.0–57.0 (54.50)	15.0–18.0 (16.30)
Iran	12	97.0–106.5 (102.40)	51.0–59.0 (55.0)	14.5–16.5 (15.67)
Fars	2	102.0, 102.0	54.0, 57.0	15.0, 16.0
Kirman	10	101.0–108.0 (103.25)	52.0–57.0 (54.23)	14.5–16.0 (15.35)
Khorasan	1	104.0	52.0	15.5
Afghanistan	9	100.0–105.0 (102.77)	52.0–57.0 (54.25)	14.0–16.0 (15.30)
Kashmir, Gilgit[b]	3	103.0–104.0 (103.66)	55.0–57.0 (56.33)	15.0–15.5 (15.16)
Gilgit, type, ad. ♂		104.0	57.0	15.5

[a] Includes one each from Kermanshah and Bakhtiari and 10 from Luristan (Durud).

[b] Includes type of *P. p. intermedia;* one of the two other specimens is an unsexed adult.

Luristan in western Persia, I refer the birds of Iran (central), those of Kirman (southeastern central), and those of Fars (south central) to *intermedia*. But as some of the specimens from these central regions do average a little darker than in the regions on either side, Luristan on the west and Afghanistan and Kashmir on the east, it is possible that study of additional material might show that the range of *exigua* extends farther south than the Elburz Mountains into central Persia.

Petronia petronia exigua Hellmayr

AZERBAIJAN: Livan, November 17–18, 1940, 3 ad. ♂.

Petronia petronia intermedia Hartert

PERSIA: Kermanshah: Gasrishirin, January 2, 1941, 1 ad. ♂. Bakhtiari: Imarat, February 17, 1 ad. ♂. Luristan: Khali Kuh, June 1, 1940, 3 ad. ♂, 2 ad. ♀; Garun, January 29, 1941, 1 ad. ♂; Durud, January 23–April 2, 3 ad. ♂, 3 ad. ♀, May 21, 1 ad. ♀, August 27–28, 1 ad. ♂, 2 ad. ♀, 1 imm. ♀, October 25–November 11, 2 ad. ♂, 2 ad. ♀. Iran: Dehibakri, January 28–29, 1940, 8 ad. ♂, 5 ad. ♀; Maskun, February 12, 4 ad. ♂, 2 ad. ♀. Fars: Persepolis, March 11, 1 ad. ♂; Dastaijin, April 8, 1 ad. ♂. Kirman: Balvard, December 30–31, 1939, 7 ad. ♂, 2 ad. ♀; Dehishib, January 17, 1940, 3 ad. ♂, 1 ad. ♀, 1 unsexed ad. Khorasan: Shahrud, September 26–27, 1 ad. ♂, 1 ad. ♀.

AFGHANISTAN: Nozi, June 22, 1937, 1 imm. ♀; Gandacheshma, July 10, 1 imm. ♂; Sufian, July 18, 1 imm. ♂, 1 imm. ♀; Zebak, July 21, 1 ad. ♀; Kargasi Pass, August 9, 1 ad. ♀; Chasmaegawan, September 9, 1939, 1 ad. ♂; Dehmiana, September 17, 1 ad. ♂; Safedsang, September 19, 1 ad. ♀; Zehnadir, September 26, 1 ad. ♀; Kotalibedak, September 26, 1 ad. ♂; Khami Deh, September 30, 5 ad. ♂, 3 ad. ♀; Burchao Pass, October 12, 1 ad. ♂.

PETRONIA XANTHOCOLLIS

The range of this species is from India westward through Sind, Afghanistan, Baluchistan, and Persia to Mesopotamia. In Mesopotamia, according to Ticehurst (1921, Jour. Bombay Nat. Hist. Soc., vol. 28, p. 230), the birds arrive in April in the date-palm areas which extend from Fao in the extreme south to Baghdad, breed in May or earlier, and leave again in August and September.

Three races have been described: the more eastern birds of India, with the exception of Sind, as *Petronia x. xanthocollis* Burton (type locality, Bengal); those of Sind, Baluchistan, and southern Afghanistan as *P. x. transfuga* Hartert (type locality, Bagu Kelat, eastern Baluchistan); and those of Persia, from

Fars westward, as *P. x. occidentalis* Koelz (type locality, Abulhassan, near Sar i Dasht, Bakhtiari).

Examination of the specimens in the Koelz collections together with other series from the American Museum of Natural History shows that these three races differ from one another principally in the general depth of their coloration. All these series were collected from February through June 15 in peninsular and central India, northern Punjab, eastern Afghanistan, Sind, eastern Baluchistan, Seistan in eastern Persia, and in western Persia from Borazjan in the western part of Fars through Bakhtiari to Dizful in Khuzistan.

Petronia x. xanthocollis is the darkest, the whole upper plumage being a light earth brown and the lesser wing coverts chestnut. Our measurements also show that it has a slightly shorter wing and tail than the other two races.

Petronia x. transfuga is exactly intermediate in coloration between *xanthocollis* and *occidentalis.* It is sandy brown, and the lesser wing coverts are considerably paler, reddish orange rather than chestnut as in *xanthocollis.* *P. x. occidentalis* is the palest of all. Above it is sandy without a touch of brown, and the lesser wing coverts are the color of pale rust. The yellow of the throat is also perhaps slightly paler than in *xanthocollis* or *transfuga,* no difference being apparent as regards this character between these last two.

In *occidentalis* the bill is also a little more slender, less thick at the base than in the other two forms. In 28 adult males from India the width of the bill at the nostril is 5.5–6.5 (6.05), in 12 from eastern Baluchistan 5.5–6.5 (5.95), and in eight from western Persia 5.2–5.8 (5.50). In terms of percentage the thickness of the bill to its length is: India 38.0–47.5 (43.20) per cent, Baluchistan 39.3–46.4 (42.86) per cent, western Persia 35.3–41.6 (38.84) per cent.

The series of *transfuga* and *occidentalis* used for comparison include the types of both and are the original series from which these two races were described. In all series there is a certain amount of individual variation in the depth or paleness of the color, but there is never any doubt as to the correct identification if comparison is based on a combination of characters—color of the upperparts, color of the lesser wing coverts, shape of bill, and measurements.

The birds of northern Punjab (Kangra) are identical to those of central and peninsular India (*xanthocollis*). Those of eastern Afghanistan (Laghman) are perhaps very slightly paler than the birds of Kangra, but the difference is extremely slight. No doubt as the populations work southward through eastern Afghanistan into eastern Baluchistan they get progressively paler.

Two specimens from Sind are indistinguishable from others of typical *transfuga* from Baluchistan. The four specimens from Seistan were collected from June 12 to 15 and are very badly worn. They appear to be a little paler than typical *transfuga* collected in March and April in eastern Baluchistan, but how much this is due to wear is impossible to tell. The bill also averages very slightly slimmer, but the size of the sample is insufficient. As in the case of the birds of Laghman, the birds of Seistan probably follow the westward trend towards a reduction in color.

COMPARATIVE COLOR NOTES OF ADULT MALES

Petronia x. xanthocollis	*Petronia x. transfuga*	*Petronia x. occidentalis*
	Paler than *P. x. xanthocollis*	Paler than *P. x. transfuga*
Upper parts light earth brown	Upper parts sandy brown	Upper parts sandy
Wing coverts chestnut	Wing coverts reddish orange	Wing coverts rust color

MEASUREMENTS OF ADULT MALES

Race and Locality	No.	Wing	Tail	Length of Bill	Width of Bill
P. x. xanthocollis					
No. India	7	81.0–85.5 (82.65)	45.0–51.0 (48.00)	13.0–14.5 (13.85)	5.5–6.4 (6.00)
C. India	6	80.0–85.5 (82.70)	47.5–52.0 (49.00)	13.0–15.0 (13.75)	5.9–6.5 (6.17)
So. India	15	81.0–88.0 (84.00)	43.0–51.0 (48.25)	13.0–15.0 (14.10)	5.7–6.5 (6.02)
P. x. transfuga					
Baluchistan	12	82.0–87.5 (85.00)	47.5–54.0 (52.00)	13.0–15.0 (13.88)	5.5–6.5 (5.95)
Seistan	4	80.0–85.0 (82.38)	48.0–54.0 (50.50)	14.0–14.5 (14.12)	5.5–6.0 (5.70)
Type ad. ♂		87.0	53.0	14.0	6.5
P. x. occidentalis					
W. Persia	8	83.0–90.0 (85.10)	47.5–54.0 (50.50)	13.0–15.0 (14.25)	5.2–5.8 (5.50)
Type ad. ♂		86.0	54.0	14.0	5.5

Petronia xanthocollis xanthocollis Burton

AFGHANISTAN: Laghman, May 25–26, 1937, 4 ad. ♂.

INDIA: Northern Punjab: Kangra, Bhadwar, March 29–April 10, 1933, 4 ad. ♂. Nepal: Simra, March 5, 1947, 1 ad. ♀; Amlekhganj, March 6, 1 ad. ♀. United Provinces: Lucknow, December 10, 1936, 1 ad. ♂; Siswa Bazar, January 30, 1947, 1 ad. ♀; Nichlaul, February 2, 1 ad. ♂; Kalnahi, February 22, 1 ad. ♂. Bihar: Muhammadganj, August 19–September 3, 1947, 1 ad. ♂, 1 ad. ♀, 4 imm. ♀; Nawadeh, November 11, 3 ad. ♂, 1 ad. ♀. Central Provinces: Bina, February 20, 1946, 2 ad. ♀; Bheraghat, March 22, 1 ad. ♂, May 17, 1 unsexed imm., December 11–13, 1 ad. ♂, 1 ad. ♀, 1 unsexed ad.; Mandla, June 25, 1 unsexed imm. Southern Bombay Presidency: Londa, January 8–March 12, 1938, 6 ad. ♂, 5 ad. ♀; Jagalbed, February 18–March 9, 4 ad. ♂, 1 ad. ♀. Madras Presidency: Nilambur, March 4, 1937, 1 ad. ♂, 1 ad. ♀; Kodur, March 18, 1 unsexed ad.; Cuddapah, March 20, 1 ad. ♂.

Petronia xanthocollis transfuga Hartert

SIND: Khinjar Lake, February 2, 1934, 1 ad. ♂; Hyderabad, April 29, 1937, 1 ad. ♀.

Petronia xanthocollis occidentalis Koelz

PERSIA: Fars: Borazjan, April 11, 1940, 1 ad. ♂. Khuzistan: Dizful, April 23, 1 ad. ♂. Bakhtiari: Abulhassan, April 28, 1 ad. ♂ (the type of *P. x. occidentalis*); Talimausur, April 28, 2 ad. ♀; Cheshmashirin, April 29, 3 ad. ♂; Belu, May 1, 1 ad. ♀; Pashmshurun, May 8–9, 2 ad. ♂, 1 ad. ♀.

Petronia brachydactyla Bonaparte

SYNONYM: *Petronia brachydactyla psammochroa* Reichenow.

WESTERN PERSIA: Bakhtiari: Marbirinji, April 25, 1940, 3 ad. ♂, 1 ad. ♀; Mulikiaulia, April 26, 1 ad. ♂, 1 ad. ♀; Sar i Dasht, April 27, 1 ad. ♂; Abulhassan, April 28, 1 ad. ♂; Siachal, April 29–May 10, 3 ad. ♂; Cheshmashirin, May 13, 1 nestling ♂; Labisufed, May 14, 1 nestling ♂. Luristan: Safed Kuh, May 11–13, 1941, 2 ad. ♂; Chamchid, May 26, 1 ad. ♂; Kalisar, June 4, 1 ad. ♂; Durud, May 7–23, 8 ad. ♂, July 5, 1 ad. ♂, August 17–26, 3 ad. ♂, 1 ad. ♀.

EASTERN PERSIA: Khorasan: Turbati Haidari, September 13, 1940, 1 ad. ♀.

The type locality of *Petronia brachydactyla* is "Arabia, Abyssinia," but although it occurs in these countries it does so only as a winter visitor, its breeding range being Syria and Persia.

Bates (1936, Ibis, p. 545), in his study of the birds of western and central Arabia, reports having seen *brachydactyla* near Mecca on April 9 moving together in an "immense flock." Some of the males dissected had the testes rather large, and the birds behaved as if "they must have been about to leave for their breeding place in Syria or Persia." Ticehurst (1921, Jour. Bombay Nat.

Hist. Soc., vol. 28, p. 230) reports on specimens which "agree well with Arabian specimens" and were collected on April 18–19 from migrating flocks "passing up the line of the Jebel Hamrin range going N.N.W." This range is just across the border from Luristan and Kermanshah.

I had no winter specimens, for all the specimens in the Koelz collection, as well as those of the American Museum of Natural History, were collected during the breeding season in Syria and Persia, including Persian Baluchistan. Examination of all these breeding specimens shows that they are indistinguishable from one another. All the adults are in worn plumage and all are identical in coloration. The measurements also are alike. Twenty-five adult males from western Persia (Luristan and Bakhtiari, 21 from April 25 to June 4, and four from July 5 to August 27) measure as follows: wing, 90.0–102.0 (96.38); tail, 42.0–52.0 (46.85); bill, 12.5–13.5 (12.90). Fifteen adult males from Syria and Lebanon (May 25 to June 18) measure: wing, 93.0–98.5 (96.0); tail, 46.0–52.0 (48.27); bill, 12.5–13.5 (13.0).

One adult male and one adult female (May 1 and 2) from Sarhad in Persian Baluchistan measure: male, wing 93.0, tail 47.0, bill 13.0; female, wing 92.0, tail 48.0, bill 13.0. No females were available from Syria, and in three from western Persia the wing is 89, 90, 94.

Sarhad is the type locality of *P. b. psammochroa* Reichenow, 1916, described as being paler and larger than *brachydactyla* from Arabia and Abyssinia. When *brachydactyla* arrives in Arabia and Abyssinia it does so in fresh winter plumage, and even though I have not examined winter specimens, I presume that in this plumage the birds would be darker than in the worn and faded plumage of the breeding season. Reichenow's *psammochroa* (paler) would appear to have been based on this difference in plumage, for when the birds have arrived to breed in Sarhad from their winter grounds in Arabia and Abyssinia, comparison shows that these topotypes of *psammochroa* do not differ in any respect from other breeding specimens from Syria and Persia.

PASSER DOMESTICUS

As the status of the House Sparrow in Persia and neighboring countries is somewhat confused, the large series in the Koelz collection offers a good opportunity for review. This series consists of 331 specimens: 196 from all parts of Persia except Seistan and Persian Baluchistan; 31 from Afghanistan; and 104 from India, the Indian series being made up of 43 from Kashmir; 11, Nepal; 6, northern Punjab; 11, United Provinces; 2, southern Bengal; 25, Bihar and Central Provinces; and 6 from southern India. Together with these, additional material from the collection of the American Museum of Natural History was examined. This additional material is made up of series from Palestine and Syria through to Iraq and Kurdestan, Zarudny's original specimens from Seistan and Persian Baluchistan, another series from Kashmir, as well as isolated specimens from southern India, Assam, northern Burma, Ceylon, Transcaucasia, Transcaspia, and Turkestan including a small series from Djarkent. In addition, Mr. Hermann Grote has kindly furnished the descriptions of two forms and Zarudny's measurements of the original series of one of these forms from the southern shore of the Caspian Sea.

It is apparent that two types of birds are present in this material, one in which the cheeks are gray or dark, and the other in which they are pure white or slightly tinged with gray. But owing to seasonal change and wear the relationships are not always easy to determine, for as the plumage wears, the cheeks get progressively paler or whiter in all the various forms and, unfortunately, despite the great quantity of material, comparative specimens were not always available.

There are, however, two other differences that can be used for discrimination. These differences, which are not always associated with the color of the cheeks, are (1) in size and (2) in the depth and richness of the color of the chestnut areas. In size, the western birds are larger and the eastern ones smaller, the birds of India from the United Provinces south being particularly smaller. In the depth of the chestnut, the more northern birds from the southern Caspian through to Nepal are darker than the birds of the Persian Plateau and those of India from the United Provinces south.

In this study all color comparisons have been made with adult male specimens in comparative state of plumage; with the exception of *P. d. semiretschieensis*, only birds in breeding, that is worn, plumage have been used.

The gray-cheeked birds follow a gentle and very gradual west to east cline in both color and size. The largest, grayest, and those with the darkest cheeks are found from Palestine and

Syria through Iraq up to and including most of western Persia. The birds of Palestine and Syria were called *P. d. biblicus* by Hartert in 1910 (type locality, Sueme, Palestine), and they differ from the nominate race by being considerably paler and by the color of the chestnut areas, which is not so deep.

After examining very large series from the Mesopotamian Plain, Ticehurst (1923, Jour. Bombay Nat. Hist. Soc., vol. 28, p. 231) states that these birds "match typical *biblicus* in every way," and that "in southwest Persia I have seen *biblicus* from Shustar, Dizful, and even up to Kermanshah. The south coast of the Caspian is inhabited by sparrows which I cannot separate from the typical form." Except as regards the birds of the south coast of the Caspian, our material largely confirms Ticehurst.

Examination of a series from Palestine and Syria, which includes the type and paratypes of *biblicus*, shows that these birds match exactly other specimens from Iraq, as well as all our specimens from Azerbaijan, Kazvin, Hamadan, and Kermanshah. However, our specimens from Durud in eastern Luristan, and those from Bakhtiari, and Dizful and Ahwaz in Khuzistan not only get smaller but also paler, both as regards cheek patches and general color, and this tendency increases as one goes farther east, until the palest and smallest birds are met with in Khorasan, Kirman, Seistan, and Persian Baluchistan. These paler birds from Luristan and Khuzistan eastward have been named *persicus* (1916) by Zarudny and Kudaschev (type locality, Karun River, Khuzistan). It is somewhat unfortunate that a type locality farther east was not chosen, for Khuzistan seems to be a region where the two forms meet and intergrade, so the statements of both Ticehurst and Zarudny could be correct. However, on the whole, our specimens from Khuzistan support Zarudny, for they are paler and smaller than *biblicus* from farther west.

North of Bakhtiari the line where *biblicus* and *persicus* meet seems to pass through east of Hamadan and Kazvin, birds from these two localities being very close to *biblicus*, if not indistinguishable from it, whereas in the region of Tehran and at Isfahan the birds are the paler and smaller *persicus*.

The birds along the southern Caspian from Talych in Transcaucasia to Gurgan (formerly Astrabad) were called *hyrcanus* (1916) by Zarudny and Kudaschev (type locality, Astrabad). Mr. H. Grote supplied the description of this form which differs from the typical (*P. d. domesticus*) and Semiryechensk sparrows by being less gray and lighter on the cheeks and sides, by having the gray on the cheeks more restricted, and by being darker on the upper parts of the body. The same differences separate it from *biblicus* which is indistinguishable from the birds of the Semiryechensk Mountains. From *persicus, hyrcanus* differs by being darker above, by having whiter cheeks, and by having the chestnut areas of a considerably darker and richer color. The measurements of Zarudny's original series supplied by Grote, as well as those given by Stresemann (1928, Jour. Ornith., vol. 76, p. 354), show also that *hyrcanus* is smaller than *biblicus* and perhaps slightly smaller than *persicus.*

My only specimens of *hyrcanus* are a small series from the type locality (Gurgan or Astrabad). Their characters are well marked and separate them well from *biblicus* and *persicus* by the differences given above. In the list of Zarudny's localities of *hyrcanus* sent by Grote, the westernmost specimen along the southern Caspian came from Resht and that of Stresemann (*loc. cit.*) came from near-by Pahlevi. Although Zarudny gives the range of *hyrcanus* as extending as far west as Talych in Transcaucasia, one adult male in my series from Talych matches exactly the larger size and color of my eastern Azerbaijan birds from Ardebil which I cannot separate from typical *biblicus* from Palestine. It appears therefore that the western end of the range of *hyrcanus* along the southern Caspian should be shortened. Until additional specimens are examined, particularly from coastal localities, it may be fixed as somewhere between Pahlevi and Ardebil.

Zarudny says that at Irak Ajmi (the region in northwestern central Persia between Hamadan and Isfahan), *hyrcanus* merges with *persicus.* In my large series I have not found in this region a single small dark bird with pale cheek patches. All my specimens are *biblicus* on the west and *persicus* on the east. So far, the *hyrcanus* specimens, the list of which was sent by Grote, the specimens of Stresemann, and mine from Gurgan all come from the other side of the great barrier of the Elburz.

In Afghanistan, with the exception of the western lowlands in which I still find *persicus,* my specimens from the rest of the country are similar in size but have paler or whitish cheeks and are also a little lighter in general coloration than my topotypical *hyrcanus.*

In northern Afghanistan, Meinertzhagen (1938, Ibis, p. 507) found *P. domesticus* breeding, as well as passing through "in a northerly direction, which must have taken them right over the Hindu Kush and down to the Oxus Valley." Some of these migrants may have continued into Turkestan. Meinertzhagen, who worked out his collection in Leningrad and therefore had the opportunity to compare his material with Russian series, calls his Afghanistan birds *P. d. bactrianus*.

This name was given by Zarudny and Kudaschev (1916) to the birds of Turkestan (type locality, Tashkent). This form, which is said by its authors to migrate largely south in winter, is described as having clearer and whiter cheeks than any of the forms considered so far (*biblicus*, *persicus*, and *hyrcanus*) and to be a little paler in general coloration than *hyrcanus*.

I have only a few isolated specimens from the range of *bactrianus* as indicated by Zarudny. These specimens, from Molla Kari, Buchara, and Merw in Transcaspia and Turkestan, are identical with my specimens from Afghanistan which appear to be breeders, as the large majority (20 out of 31) were collected from May 17 to August 16 and the others from September 5 to November 5. My specimens from Afghanistan are paler than my topotypical specimens of *hyrcanus;* the chestnut color is not so intense or dark, the gray on top of the head is distinctly lighter and less streaked, and the cheeks are white or only slightly tinged with gray. From *persicus* they differ not only by the color of the cheeks which in *persicus* are always gray, never clear nor ever white, but also by the richer color of the chestnut, and by the slightly but generally darker coloration of the upper parts.

From good series collected from April 29 to August 25 in Kashmir and extreme northern Punjab, the birds of Afghanistan differ by being paler, the chestnut areas in the birds of Kashmir and northern Punjab being considerably darker. The chestnut color is also richer, the nuchal band of chestnut is broader and extends farther down onto the mantle, and in all specimens but one is pure, and does not show an admixture of gray feathers as is almost always present in the birds from Afghanistan. The cheeks are white or only very slightly tinged with gray as in the Afghan birds. The birds of Kashmir and northern Punjab also average slightly larger than those of Afghanistan.

The birds of Kashmir and of the areas north of the outer ranges of the western Himalayas have been described by Whistler as *parkini* in 1920 (type locality, Srinagar, Kashmir), the comparison being made with the birds from farther south in India (*indicus*) from which they differ by their considerably larger size, heavier bill, and richer and deeper chestnut.

Meinertzhagen (1938, Ibis, p. 507) and Whistler (1945, Jour. Bombay Nat. Hist. Soc., vol. 45, p. 117) consider that the birds of Kashmir are identical with those of Turkestan and Afghanistan, but I have shown above that the Kashmir birds are distinct, the degree of distinction being certainly as well marked as between any of the races of *P. domesticus* included in this study, and I therefore believe that *parkini* is perfectly valid and should be retained.

Whistler (1945, *loc. cit.*) shows that a specimen of *P. domesticus*, an immature male, collected at Kandahar in southern Afghanistan on April 9, 1881, was named *P. griseigularis* by Sharpe in 1881. He further states that since he cannot see any difference in size or color between the birds of southern Afghanistan and Turkestan, the name *bactrianus* is antedated by *griseigularis*. However, in view of the fact that Whistler failed to distinguish, perhaps owing to insufficient material or material not in comparative state of plumage, between the birds of Kashmir and those of Afghanistan (which I believe can be rather easily separated) I am not convinced that the breeding form of southern Afghanistan is necessarily identical with breeding birds farther north in the mountainous regions of central and northern Afghanistan and Turkestan. Until good breeding series can be compared I follow Meinertzhagen and retain the name *bactrianus* for these latter.

I have another reason for doing so. Kandahar is at the very edge of the southern lowlands, and on the western part of these, at Farah, I have found *persicus*, and presumably *indicus* is the breeding form in Baluchistan. In the lowlands of southwestern Afghanistan the three forms may meet, and the name *griseigularis* cannot therefore be applied with certainty to any. For the time being, *P. griseigularis* must be considered as unidentifiable.

In addition to birds from Kashmir and northern Punjab, I have good series of Indian specimens from Nepal, United Provinces, Bihar, and Central Provinces, a small series from southern India, as well as other scattered Indian specimens. With the exception of the Nepal series, all the other Indian birds (*indicus*) are similar in size and color, that is, lighter in color and considerably smaller than the birds of Kashmir and northern Punjab.

The Nepal series is made up of large birds identical in size with those of Kashmir and northern Punjab, but slightly lighter in color. The chestnut is not quite so dark nor so pure on the back of the neck. However, these Nepal birds are much closer to *parkini* than they are to *indicus*, and since their measurements are identical with those of *parkini*, I think that they are best referred to this form.

Baker (1926, Fauna of British India, vol. 3, p. 169) divided the birds of India, south of the Himalayas, into two forms, on the basis that in the birds south of northern Central India and Bihar the color of the chestnut areas was deeper, the black on the breast more extensive, and the white wing patch purer and larger. These more southern birds he calls *P. d. nigricollis* Burton, 1838. I have seen too few southern Indian birds, but those that I have examined show no constant color difference by which they could be separated from those of northern India, south of the Himalayas. As Whistler (1933, Jour. Bombay Nat. Hist. Soc., vol. 36, p. 838) remarks, the birds from these two regions are identical in size and do not appear to differ in color.

The scattered specimens from Ceylon, Bengal, Assam, and northern Burma are identical in measurements with *indicus*, and there is no apparent color difference.

Another race of *P. domesticus* described by Zarudny and Kudaschev is *P. d. semiretschieensis* in 1916 (type locality, according to Hartert, Djarkent and Verni). This form, from the Semiryechensk Mountains in the eastern part of Russian Turkestan, is said to resemble *P. d. domesticus* but to be lighter. This is the only character that separates *P. d. biblicus* from *P. d. domesticus*. In the collection of the American Museum of Natural History there are six topotypes from Djarkent, two males and four females, one of the latter being one of Zarudny's specimens. All of these Djarkent birds are paler than *P. d. domesticus* but can be matched perfectly in color and size by typical (including type and topotypes) *biblicus* from Palestine, collected at comparable dates only a week or so apart. Buturlin and Dementiev (1934, L'Oiseau, vol. 4, p. 510) make *semiretschieensis* a synonym of *P. d. domesticus*, but my examination shows that this name should be, instead, a synonym of *biblicus*. As the range of *P. d. domesticus* extends to the north and east of

Turkestan, the birds of the Semiryechensk occupy in the east the same position in the cline in the reduction of pigment represented in the west by *biblicus*.

The name *Passer enigmaticus* was given by Zarudny in 1903 to a sparrow collected by him in Persian Baluchistan. The description of the new form shows that it is exceedingly similar to the female of *P. domesticus*, but differs in that both of the specimens are males and have an admixture of chestnut on the postocular stripe, lesser upper wing coverts, and outer webs of the feathers of the mantle.

No other specimens of *enigmaticus* other than these two have ever been found, but in the Koelz collection there are several specimens which, by presenting a mixture of male and female characters, appear to throw a good deal of light on the status of *enigmaticus*. Chief among these are an adult female from Thankot in Nepal, an unsexed adult from Bandipur in Kashmir, and an adult male from Khalat in Afghanistan. Some of these specimens match the description of *enigmaticus* and are discussed elsewhere in detail by Mayr (in press), whose conclusion is that the evidence of these specimens suggests that *enigmaticus* is a freak intersex of *P. domesticus*. As Zarudny's specimens were collected in an area where *persicus* passes into *indicus*, Mayr proposes, and I follow him, that, rather than upset the present nomenclature, the name *enigmaticus* should be placed in the synonymy of *indicus*.

In summary, the forms recognized as valid by this study, with a brief diagnosis of their characters, their ranges, and the measurements of the principal series, follow. The measurements are those of adult males. Color comparisons were made only with male specimens in breeding, that is, worn plumage, but birds in which the plumage was very worn were excluded.

Passer domesticus biblicus Hartert, 1910

SYNONYM: *Passer domesticus semiretschieensis* Zarudny and Kudaschev, 1916.

DIAGNOSIS: Lighter than *P. d. domesticus*, cheeks lighter than in *domesticus* but always darker and more solidly gray than in any of the subsequent forms.

RANGE: Palestine and Syria, through Iraq and Kurdestan, up to and including Azerbaijan and western Persia westward from Kazvin, Hamadan, and western Luristan; the region of the Semiryechensk in Russian Turkestan.

MEASUREMENTS

Locality or Region	No.	Wing	Bill
Palestine and Syria through Iraq to Kurdestan	14	78.5–84.0 (81.07)	13.5–15.0 (14.32)
Type of *biblicus*, ad. ♂ (Sueme, Palestine)	1	81.5	14.0
Gasrishirin and Kermanshah	11	79.0–85.0 (81.45)	13.0–14.5 (14.00)
Azerbaijan	15	79.0–84.0 (82.00)	13.0–14.5 (13.75)
Hamadan	3	82.5–85.0 (83.50)	13.0–13.5 (13.33)
Semiryechensk Mts. (Djarkent)	2	80.0, 81.0 (80.50)	14.5, 14.5 —

Passer domesticus persicus Zarudny and Kudaschev, 1916

DIAGNOSIS: Paler than *biblicus* and slightly smaller in size, cheeks always gray but of a paler gray.

RANGE: Persia (with the exception of the southern shore of the Caspian) eastward of the range of *biblicus*, as far as and including Khorasan, the lowlands of southwestern Afghanistan, Seistan, and Persian Baluchistan.

MEASUREMENTS

Locality or Region	No.	Wing	Bill
Eastern Luristan (Durud) and Bakhtiari	14	76.0–84.0 (79.90)	12.5–14.0 (13.30)
Eastern Khuzistan	8	76.0–82.0 (79.40)	13.0–14.5 (14.00)
Iran and Yezd	23	76.0–83.0 (79.30)	11.5–14.0 (12.85)
Fars and Laristan	15	77.0–83.0 (79 30)	12.0–13.5 (12.47)
Kirman	16	75.0–80.0 (77.97)	11.0–13.0 (12.10)
Seistan (very worn)	3	73+–76+ (74.70+)	12.5–13.0 (12.83)
Persian Baluchistan	10	74.0–79.0 (77.25)	12.5–14.0 (13.00)
Khorasan	11	73.0–81.0 (76.59)	12.0–13.0 (12.67)

Passer domesticus hyrcanus Zarudny and Kudaschev, 1916

DIAGNOSIS: Darker above than *persicus*, chestnut considerably richer and darker, top of crown slightly streaked with black, cheeks very pale with the gray fainter and more restricted.

MEASUREMENTS

Locality or Region	No.	Wing	Bill
Gurgan (topotypical), worn	4	75.0–79.0 (77.00)	12.0–14.0 (13.12)
Tarsakan and Chikishlyar to Resht (Zarudny)	10	74.0–81.0 (78.42)	— — —
Barforush (Babul) to Pahlevi (Stresemann, 1928)	12	73.0–77.0 (75.17)	— — —

RANGE: Southern shore of the Caspian from Tarsakan in southwestern Transcaspia (Zarudny), westward to western Gilan west of Pahlevi.

Passer domesticus bactrianus Zarudny and Kudaschev, 1916

DIAGNOSIS: Upper parts lighter than *hyrcanus* but a little darker than in *persicus*, chestnut not so intense nor so dark as in *hyrcanus* and gray on top of the crown lighter and not streaked, cheeks clearer than *hyrcanus*, white or only very slightly tinged with gray.

RANGE: Russian Turkestan except in the northeast, the plains of the Syr-Daria and the Aral Sea, Transcaspia, east of Tarsakan, and Afghanistan except in the lowlands of the south and southwest.

MEASUREMENTS

Locality or Region	No.	Wing	Bill
Central and northern Afghanistan (worn)	9	75.0–79.0 (77.16)	13.0–14.0 (13.28)
Central and northern Afghanistan (fresh)	7	74.0–81.0 (78.80)	

Passer domesticus parkini Whistler, 1920

DIAGNOSIS: Upper parts darker than in *bactrianus* but not quite so dark as in *hyrcanus*, chestnut considerably darker than in *bactrianus*, and on the back of the neck and mantle, purer and more extensive. Chestnut is of a richer color than in any of the preceding forms, cheeks are clearer than in *hyrcanus*, whitish or white as in *bactrianus*.

RANGE: Kashmir, probably Tibet, northern Punjab north of the outer folds of the Himalayas, Nepal above the southern plain.

MEASUREMENTS

Locality or Region	No.	Wing	Bill
Kashmir	12	76.0–82.0 (80.20)	13.0–14.0 (13.50)
Northern Punjab (Kulu and Lahul)	6	74.0–85.0 (79.39)	12.5–13.5 (13.16)
Nepal (Thankot)	7	75.5–81.0 (78.43)	13.0–14.5 (13.80)

Passer domesticus indicus Jardine and Selby, 1831

SYNONYMS: *Pyrgita nigricollis* Burton, 1838.
Passer enigmaticus Zarudny, 1903.

DIAGNOSIS: Considerably smaller than any of the preceding forms, chestnut not so dark nor so rich as that of *parkini*, bill shorter than *parkini*, and less heavy than in any of the preceding forms, general coloration light, cheek patches white.

RANGE: India, south of the Himalayas. Baluchistan, Ceylon, Burma.

MEASUREMENTS

Locality or Region	No.	Wing	Bill
United Provinces (Nichlaul)	7	72.0–76.0 (73.93)	11.5–13.0 (12.07)
Bihar	3	73.0–75.0 (73.66)	12.0–13.0 (12.33)
Surguja	2	71.0, 74.0 (72.50)	12.5, 12.5 —
Northern Central Provinces (Bheraghat)	9	71.5–78.0 (75.44)	12.0–13.0 (12.40)
Southern India (Londa and Nilghiris)	7	70.0–77.0 (74.36)	12.0–13.5 (12.86)
Northern Burma (Bhamo)	2	74.5, 74.5 —	13.0, 13.0 —
Type of *indicus*, ad. ♂ (Bangalore, Mysore)	1	74.0	12.5

The type locality of *indicus* was fixed as Karachi, Sind, by Baker (1926, Fauna of British India, vol. 3, p. 170). However, Kinnear (1925, Ibis, p. 752) has shown that this locality was arbitrarily chosen and that the type probably came from Bangalore.

In the extensive material of this study the only actual specimens that showed evidence of intergradation (in this case between *biblicus* and *persicus*) were some from western Persia in Bakhtiari, eastern Luristan, and eastern Khuzistan. In Baluchistan proper, from which I had no specimens, *persicus* is replaced by *indicus* as the breeding form. Interesting regions where three forms probably meet are southwestern Transcaspia for *hyrcanus*, *persicus*, and *bactrianus*, and the lowlands of southern Afghanistan for *persicus*, *bactrianus*, and *indicus*.

Passer domesticus biblicus Hartert

KERMANSHAH: Kermanshah, December 27, 1940, 1 ad. ♂; Gasrishirin, December 29, 1940–January 1, 1941, 10 ad. ♂, 2 ad. ♀, 7 imm. ♀.

WESTERN IRAN: Kazvin, October 23, 1 ad. ♂; Amirabad, December 19, 1 ad. ♂; Hamadan, December 21–23, 2 ad. ♂, 1 ad. ♀.

AZERBAIJAN: Tabriz, October 10–31, 4 ad. ♂, 1 ad. ♀; Gharibdast, October 25, 1 ad. ♂, 1 ad. ♀: Sarab, November 1, 1 ad. ♂, 1 imm. ♀; Ardebil, November 3–4, 2 ad. ♂, 1 ad. ♀; Namin, November 6, 1 imm. ♀; Livan, November 14, 1 ad. ♀; Sanjbulagh, December 3–5, 3 ad. ♂, 2 ad. ♀; Dashagli, December 5, 3 ad. ♂, 4 ad. ♀; Khoi, December 10, 1 ad. ♂.

Passer domesticus persicus Zarudny and Kudaschev

KHUZISTAN: Ahwaz, April, 22, 1940, 6 ad. ♂; Dizful, April 23 and May 17, 2 ad. ♂.

LURISTAN: Durud, May 21–24, 1940, 1 ad. ♂, 2 ad. ♀, January 23–26, 1941, 3 ad. ♂, 1 ad. ♀, March 9, 2 ad. ♂, May 2, 1 ad. ♂; Burujird, June 19, 1 ad. ♀, September 24, 1 ad. ♂.

BAKHTIARI: Mulikiaulia, April 26, 1940, 1 ad. ♀; Ti, February 1–10, 1941, 7 ad. ♂, 4 ad. ♀, 1 imm. ♀; Imarat, February 16, 1 ad. ♀.

IRAN: Khatumabad, January 31, 1940, 1 ad. ♀; Dehidisk, February 1, 3 ad. ♂: Tomogaon, February 3–7, 5 ad. ♂, 2 ad. ♀; Isfahan, March 3–4, 2 ad. ♂; Sharifabad, October 22, 3 ad. ♂, 1 imm. ♀; Gurveh, October 34, 1 ad. ♂; Karaj, March 25, 1945, 1 ad. ♂, July 17, 1 imm. ♀, October 29–November 7, 3 ad. ♂, 1 ad. ♀. Yezd: Shir Kuh, Dehibala, February 21–25, 1945, 4 ad. ♂, 2 ad. ♀.

FARS: Surmag, March 7, 1940, 2 ad. ♂, 2 ad. ♀; Eglit, March 8, 1 ad. ♂; Persepolis, March 12, 3 ad. ♂, 1 ad. ♀; Shiraz, March 15 and April 7, 2 ad. ♀; Jahrum, March 25, 1 ad. ♂; Istanabad, March 27, 1 ad. ♂; Niriz, March 30, 4 ad. ♂, 3 ad. ♀; Borazjan, April 11, 1 imm. ♀.

LARISTAN: Isin, December 16–19, 1939, 1 ad. ♂, 2 ad. ♀; Bandar Abbas, December 21, 2 ad. ♂.

KIRMAN: Madenu, December 27–28, 1939, 4 ad. ♂; Dehibala, January 7, 1940, 1 ad. ♂; Khabis, January 13, 1 ad. ♂; Chaharfarsakh, January 15, 2 ad. ♀; Dehishib, January 17, 1 ad. ♀; Kirman, January 18–20, 5 ad. ♂, 1 ad. ♀; Paibene, February 14, 1 ad. ♂; Darzin, February 15, 1 ad. ♀; Maskun or Mahun, February 16, 3 ad. ♂, 1 ad. ♀.

KHORASAN: Bujnurd, August 2–8, 1940, 1 ad. ♂, 1 imm. ♀; Karak, August 7, 1 ad. ♂; Bardu, August 16–21, 3 ad. ♂, 3 ad. ♀; Bijistan, August 26, 1 ad. ♂; Firdaus, August 29–30, 2 ad. ♂, 1 imm. ♂, 2 ad. ♀, 1 imm. ♀; Robatikhan, September 3, 1 imm. ♂; Gunabad, September 9, 1 ad. ♂, 1 ad. ♀; Sultanabad, September 22, 1 imm. ♂.

SOUTHWESTERN AFGHANISTAN: Farah, October 30, 1937, 1 ad. ♂.

Passer domesticus hyrcanus Zarudny and Kudaschev

SOUTHERN CASPIAN, MAZENDERAN: Gurgan (Astrabad), July 27–30, 1940, 3 ad. ♂, 2 ad. ♀, October 1, 2 ad. ♂, 2 imm. ♀.

Passer domesticus bactrianus Zarudny and Kudaschev

AFGHANISTAN: Kabul, May 17, 1937, 1 ad. ♂, 2 ad. ♀; Laghman, May 25, 1 ad. ♂; Nazhil, May 29, 1 ad. ♂; Gardez, June 15–20, 1 ad. ♂, 1 ad. ♀; Nozi, June 22, 2 ad. ♂, 2 ad. ♀; Tagan, June 8, 1 ad. ♂; Sirotai, June 20, 1 ad. ♀; Baghlan, July 1, 2 ad. ♂: Khanabad, July 2, 1 ad. ♀; Gumbaz, Kishm, July 7, 1 ad. ♀; Zebak, July 20–21, 1 ad. ♀, 1 imm. ♀; Tuti, August 16, 1 imm. ♀; Balkh, September 5, 2 ad. ♂, 1 ad. ♀; Aq Chah, September 8, 1 ad. ♂; Bagrami, September 28–29, 2 ad. ♀; Khalat, October 14, 1 ad. ♂; Tuksar, September 16, 1939, 1 ad. ♂; Dehmiana, September 17, 1 ad. ♂; Pul i Khumri, November 5, 1 imm. ♀.

Passer domesticus parkini Whistler

KASHMIR: Bandipur, July 30, 1936, 2 imm. ♂, 1 unsexed ad.; Gurais, August 3, 1 ad. ♂. Baltistan: Safaranga, August 18, 2 ad. ♂, 1 ad. ♀, 1 imm. ♀; Kafalu, August 21–27, 2 ad. ♂, 2 imm. ♀; Dagoni, August 24–25, 1 ad. ♂, 3 ad. ♀; Khalan, August 30, 1 imm. ♀; Biodkang, September 3, 1 ad. ♂, 1 imm. ♂, 1 ad. ♀; Udmaro, September 6, 1 imm. ♀; Hundi, September 7, 5 ad. ♂, 3 ad. ♀, 1 imm. ♀; Karzong, September 13, 1 ad. ♂. Ladakh: Shyok Valley, Kampuk, September 8, 1936, 1 ad. ♀; Pitug, September 19–20, 1936, 4 ad. ♂, 1 imm. ♂; Spituk, September 21, 1 imm. ♂, 2 ad. ♀, 2 imm. ♀; Gya, September 25, 1 ad. ♂.

NORTHERN PUNJAB: Kulu: Bandrole, June 1, 1936, 1 ad. ♂. Lahul: Kolung, June 16, 1 ad. ♂; Koksar, August 25, 2 ad. ♂, 1 ad. ♀; Kyelang, October 19, 1 ad. ♀.

NEPAL: Thankot, March 31–April 12, 1947, 7 ad. ♂, 4 ad. ♀.

Passer domesticus indicus Jardine and Selby

UNITED PROVINCES: North: Nichlaul, January 31–February 15, 1947, 6 ad. ♂, 4 ad. ♀; south: Benares, January 23, 1 ad. ♂.

SOUTHERN BENGAL: Dacca, January 16, 1937, 2 ad. ♂.

BIHAR: Muhammadganj, August 28–September 2, 1947, 3 ad. ♂, 2 ad. ♀.

SURGUJA: Ramanujganj, October 9–10, 1947, 2 ad. ♂.

CENTRAL PROVINCES: Bheraghat, March 5–26, 1946, 4 ad. ♂, 1 ad. ♀, December 3–19, 5 ad. ♂, 3 ad. ♀; Bichhia, July 9–14, 2 ad. ♂, 1 imm. ♂, 2 ad. ♀.

SOUTHERN INDIA: Southern Bombay Presidency, Londa, January 1–March 13, 1938, 4 ad. ♀. Madras Presidency: Nilghiri Hills, Ootacamund, February 18, 1937, 1 ad. ♂; Cuddapah, March 30, 1 ad. ♂.

Passer hispaniolensis transcaspicus Tschusi

PERSIA: Bakhtiari, Sar i Dasht, April 27, 1940, 3 ad. ♂. Mazenderan, Gurgan, October 1, 1 imm. ♂. Kermanshah, Gasrishirin, January 1–9, 1941, 6 ad. ♂, 7 ad. ♀. Luristan, Durud, April 2–9, 3 ad. ♂, 6 ad. ♀.

AFGHANISTAN: Bagrami, September 29–October 1, 1937, 3 ad. ♂, 1 ad. ♀; Kandahar, October 23, 1 ad. ♀.

In breeding plumage this race is extremely close to, and cannot with certainty be separated from, the nominate race in similar plumage, though the chestnut of the crown in *transcaspicus* is not quite so rich. In winter plumage, however, the two are quite distinct; *transcaspicus* is paler, less rusty and lighter above, and the edges of the outer webs of its wing and tail feathers are considerably lighter than in *hispaniolensis*.

There are no differences in color or size between the specimens from Persia and those of Afghanistan. A male of typical *transcaspicus* collected on January 27 at Tedshen, Transcaspia, matches perfectly the color of my January specimens from western Persia, and its size is identical.

My specimens of *P. hispaniolensis* and *P. domesticus* collected together in Persia and Afghanistan show no evidence whatsoever of hybridization.

MEASUREMENTS: Wing: 15 males, 78.5–85.0 (81.13); 15 females, 74.0–81.0 (77.24). Tail: 14 males, 49.0–60.0 (54.50); 15 females, 48.0–55.0 (51.64). Bill: 15 males, 13.0–15.0 (13.85); 15 females, 13.0–14.0 (13.37).

PASSER MONTANUS

The series of the Tree Sparrow collected by Koelz consist of 124 specimens. A study of this material together with the collection of the American Museum of Natural History shows that the Koelz specimens represent three forms. These three subspecies can be distinguished from one another by their coloration. The differences are best appreciated on the upper parts, particularly the mantle and the rump. These three races are:

Passer m. transcaucasicus Buturlin, 1906. The more western series from northern Persia collected in Azerbaijan, at Karaj, and in the mountains above Gurgan differs from a series of typical *P. m. montanus* from western Europe in being duller above, a little lighter, grayer and less rufous, and by having the center of the belly whiter, and the bill slightly shorter. These characters agree well with the description of *transcaucasicus* whose range is given by Buturlin and Dementiev (1935) as Transcaucasia and the southern shores of the Caspian.

The measurements of the three races, together with those of a series of *P. m. montanus*, are given below. The only difference which may be of significance is the shorter bill of *transcaucasicus*. *P. m. dilutus* appears to have the wing and tail a little longer than the others, but seen as a whole the size differences are too slight to be of use in discrimination.

Passer m. dilutus Richmond, 1895. This race, whose type locality is Kashgar in Eastern (Chinese) Turkestan, was described as being considerably paler everywhere than *P. m. montanus*.

My material from eastern Persia (Khorasan) and that of Afghanistan is identical in size with, and shows no significant difference in color from, a series from Djarkent in the eastern part of Western (Russian) Turkestan, and with three specimens from Khotan in Eastern Turkestan. All the specimens, both above and below, are paler than *transcaucasicus* and considerably paler than *montanus*, *transcaucasicus* being intermediate between *dilutus* and *montanus*. But if only isolated specimens of *transcaucasicus* are compared to others of *dilutus*, particularly from the more western part of the range of this latter, they are seen to differ very little.

The birds from eastern Persia (the western extremity of the range of *dilutus*) were called *pallidus* by Zarudny in 1903. Snigirewski (1928, Jour. Ornith., vol. 76, p. 591) states that *pallidus* differs from *dilutus* by having a shorter tail and wing, and by being grayer, particularly on the rump. The measurements given below fail to confirm this size difference. The rump on my three Eastern Turkestan specimens is perhaps very slightly paler than in my birds from eastern Persia, but the difference is so minute that, lacking other characters (such as the size), I think *pallidus* cannot be maintained.

Passer m. malaccensis Dubois, 1885. My series from Nepal is darker and decidedly more reddish above than my specimens of *dilutus* and is brighter as well as more reddish than my specimens of *transcaucasicus*. These Nepal birds do not differ in either color or size from other series of *malaccensis* from the Indo-Chinese countries and Hainan, as well as from scattered specimens from the Greater Sundas and the Malay Peninsula (including topotypical *malaccensis* from Malacca). But though *malaccensis* is distinctly different from *dilutus* and *transcaucasicus*, it is, on the other hand, extremely close to *montanus*. I cannot see any difference in the color of the under parts between my specimens of *montanus* from western Europe and those of *malaccensis* from Nepal and the other regions given above. In the color of the upper parts there is a very slight color difference, but only as a series, the difference being really perceptible only on the rump, which in *malaccensis* averages a little more rufous. The differences in the measurements appear to be too slight to be of significance. The question whether or not *malaccensis* is really separable from *montanus* can be settled only by more abundant and fresher series than are available to me. These series should consist of birds in comparative plumage representing all the various stages of wear, for with wear the crown in all the specimens of *P. montanus* that I have examined turns redder, and the color of the mantle and rump more rufous.

The ranges of *P. m. transcaucasicus* and *P. m. dilutus* in Persia and Afghanistan are shown in figure 1. Localities reported by Zarudny and Härms, Stresemann, Paludan, and Whistler are included. Although some of the localities of Zarudny and Härms, and Whistler, as well as several of mine from Afghanistan, could not be found, they all fall within the ranges indicated on the map.

The distribution follows in a striking manner the trend of the northern mountains, the species being lacking entirely on the Persian Plateau and in the lowlands of southwestern Afghanistan.

MEASUREMENTS

Region or Locality	No.	Wing	Tail	Bill
P. m. montanus				
Western Europe	11	65.0–72.0 (68.60)	46.0–50.0 (48.46)	12.0–13.0 (12.36)
P. m. transcaucasicus				
Northern Persia	19	66.0–72.5 (68.67)	47.0–56.0 (51.10)	10.5–12.0 (11.10)
P. m. dilutus				
Eastern Persia (Khorasan)	5	71.0–76.5 (74.10)	51.0–60.0 (55.70)	12.5–13.0 (12.50)
Baluchistan	4	73.0–73.5 (73.25)	50.0–54.5 (53.00)	12.0–12.5 (12.12)
Afghanistan	21	72.0–77.0 (73.90)	50.0–59.0 (54.30)	11.5–13.0 (12.12)
Western Turkestan (Djarkent)	8	70.0–77.0 (73.30)	52.0–56.0 (53.70)	12.0–13.5 (12.50)
Eastern Turkestan (Khotan)	3	72, 73, 75 (73.34)	54, 55, 56 (55.00)	12.5, 13, 13 (12.83)
P. m. malaccensis				
Nepal	6	70.5–73.5 (72.50)	47.0–56.5 (52.92)	12.5–14.0 (13.16)
Indo-Chinese countries	7	68.0–71.5 (69.80)	47.5–54.0 (51.00)	12.5–13.5 (13.00)
Hainan	9	68.0–72.5 (70.22)	48.0–52.0 (50.28)	12.5–13.8 (13.22)

Passer montanus transcaucasicus Buturlin

AZERBAIJAN: Tabriz, October 30–31, 1940, 2 ad. ♂, 2 ad. ♀, 1 imm. ♀, 1 unsexed ad., December 14, 1 ad. ♂; Ardebil, November 2, 1 ad ♀; Sarab, November 8, 1 ad. ♂, 2 ad. ♀; Maraghe, November 25–December 1, 5 ad. ♂, 2 ad. ♀; Rezaieh, December 8, 1 unsexed ad.

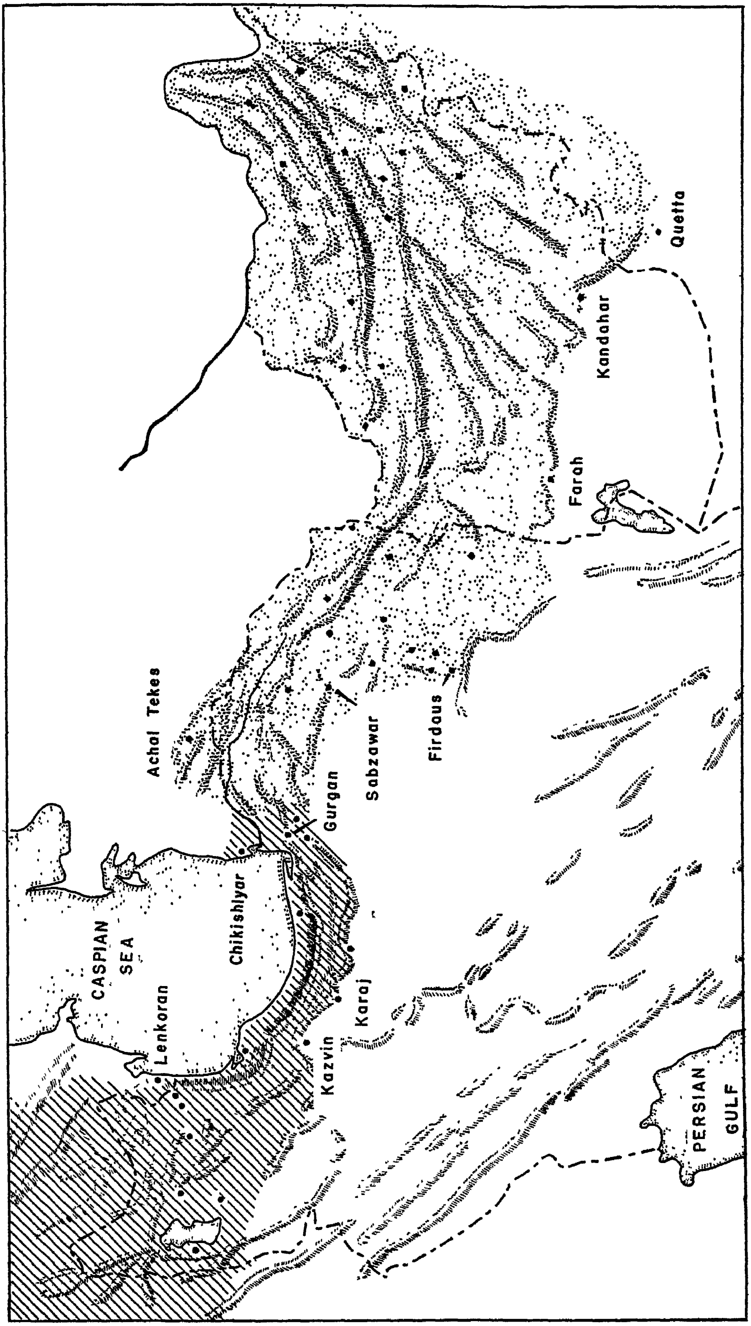

FIG. 1. Range of *Passer montanus* in Persia and Afghanistan. Diagonal lines: *P. m. transcaucasicus.* Stippling: *P. m. dilutus.*

MAZENDERAN: Rubatikarim, July 16, 1940, 1 ad. ♂; Shah Kuh, July 20, 1 imm. ♂; Karimserai, July 20–22, 2 ad. ♂, 2 imm. ♂, 2 ad. ♀, 5 imm. ♀; Dimalu, July 22, 1 imm. ♀.

NORTHERN IRAN: Karaj, February 19, 1943, 1 ad. ♀, March 1, 1944, 2 ad. ♂, December 8, 1 ad. ♂, October 20–November 18, 1945, 4 ad. ♂, 5 ad. ♀.

Passer montanus dilutus Richmond

Synonym: *Passer montanus pallidus* Zarudny.

NORTHEASTERN PERSIA, KHORASAN: Garmah, August 3, 1940, 3 imm. ♂, 1 ad. ♀; Firdaus, August 30, 1 ad. ♂, 1 imm. ♂, 1 ad. ♀; Gunabad, September 9, 1 ad. ♂, 1 imm. ♂; Turbati Haidari, September 12, 1 ad. ♂; Nishabur, September 20, 3 ad. ♀; Sultanabad, September 22, 1 ad. ♂, 1 ad. ♀; Sabzawar, September 23, 1 ad. ♀.

BALUCHISTAN: Quetta, November 26–27, 1939, 1 ad. ♂, 1 ad. ♀; Spezand Junction, January 19, 1946, 3 ad. ♂, 1 ad. ♀.

AFGHANISTAN: Gulbahar, May 14, 1937, 2 ad. ♀; Laghman, May 25–26, 2 ad. ♂; Gardez, June 15–16, 1 ad. ♂, 1 ad. ♀; Khanabad, July 2–3, 1 ad ♀, 1 nestling ♂ and 1 nestling ♀; Faizabad, July 12, 1 ad. ♂; Sanglech, July 27, 1 ad. ♂, 2 nestling ♂; Bagrami, September 28–October 1, 2 imm. ♀; Laorlash, October 7, 1 ad. ♀; Mukur, October 10, 1 ad. ♂; Karabagh, October 10, 3 ad. ♂; Farah, November 7–9, 3 ad. ♂, 2 ad. ♀; Bala Murghab, November 15, 1 ad. ♂; Maimana, November 16–18, 3 ad. ♂, 3 ad. ♀; Kabul, December 14, 2 ad. ♂, 2 ad. ♀; Jalalabad, December 19, 1 ad. ♂; Doao, August 23, 1939, 1 unsexed imm.; Bai, September 19, 1 imm. ♂; Sufak, September 27, 1 ad. ♂, 1 imm. ♂, 3 ad. ♀.

INDIA, NORTHWEST FRONTIER PROVINCE: Parachinar, May 7–8, 1936, 2 ad. ♂.

Passer montanus malaccensis Dubois

NEPAL: Bhimpedi, March 11–13, 1947, 2 ad. ♂, 1 ad. ♀, May 3, 1 ad. ♂; Chitlang, March 15, 1 ad. ♀; Thankot, April 8–29, 3 ad. ♂, 2 ad. ♀.

Passer rutilans cinnamomeus Gould

NORTHERN PUNJAB: Kulu, Bandrole, May 31, 1936, 1 ad. ♂; Kangra, Kotla, January 27, 1946, 2 ad. ♂.

The length of the wing measures: 72, 72, 73.5. In other adult male specimens from the collection of the American Museum of Natural History, the same measurement is: northern Punjab, 72, 72.5, 75, 75; Ladakh, Kashmir, 71, 72, 72, 72, 72.5, 72.5, 73, 73.

Hartert in 1910 (Die Vögel der paläarktischen Fauna, vol. 1, p. 162) separated the birds of the Himalayas west of Nepal as *P. r. debilis* on account of their being somewhat smaller and lighter in color above than the birds found from Nepal eastward.

But Kinnear (1922, Ibis, p. 521) later showed that there is no constant color difference and no significant size difference between the western and eastern Himalayan populations.

On the other hand the populations from the high plateau of southern Tibet, as well as from northern Bhutan and probably northern Sikkim, have been shown by Stresemann (1939, Ornith. Monatsber., vol. 47, p. 176) to be considerably larger than the more southern birds in the Himalayas. A series of 19 adult males of this larger race, which Stresemann calls *P. r. schaeferi*, measure for the wing 77–82 (78.5), as against 71–75 (72.67) for 15 adult males from Kashmir and northern Punjab.

In my specimens the wing in five adult males from Sikkim and Bhutan measures: Sikkim, 74+ (very worn), 77, 78.5; Bhutan, 77.5, 80. Unfortunately no further localities are given, but the measurements of the unworn birds fit within the range of variation of *schaeferi*.

With wear the whole plumage turns distinctly lighter, the lower parts become paler, and the bright chestnut red of the upper parts turns into a rusty orange. The type of *P. r. debilis* was collected on July 19, 1873, and is in extremely worn and faded plumage, which probably accounts for the difference in color seen by Hartert.

Passer pyrrhonotus Blyth

PUNJAB: Lahore, November 29, 1936, 2 ad. ♂.

This little sparrow is found locally in Sind and Punjab and has been collected twice in southern Persian Baluchistan during March by Zarudny and Härms.

MEASUREMENTS: Wing: 68.0, 69.0; tail: 47.0, 50.5; bill: 11.5, 12.0.

Three additional adult specimens from the collection of the American Museum of Natural History measure: one male, January 25, Lahore, wing 67, tail 50.5, bill 11.5; one male, no date or locality, Sind, wing 68, tail 48, bill 11.5; one female, no date, eastern Narra, Sind, wing 65, tail 48, bill 11.5.

MONTIFRINGILLA NIVALIS

Two races of *Montifringilla nivalis* were collected by Koelz, *M. n. alpicola* and *M. n. gaddi*. *Montifringilla n. gaddi*, probably owing to insufficiency of comparative material, has been hitherto considered to be only a synonym of *M. n. alpicola*. Our extensive series, however, which contains specimens in all states of plumage, now amply confirms its validity.

Montifringilla n. gaddi was described as having a longer bill, blacker lores, paler plumage, and the white areas of the tail more developed than in typical *M. n. alpicola* from the Caucasus. Our specimens do not bear out the difference in the bill length, nor that of the darkness of the lores, a character which appears to be connected with the state of the plumage. But *gaddi* is whiter below, and paler, more rufous, and less gray above than *alpicola*. It also has larger white areas in the tail feathers, as well as on the inner primaries, than in *alpicola*.

In coloration, *M. n. gaddi* is similar to another hard to distinguish race, *M. n. groum-grzimaili* from eastern Tian Shan and southeastern Altai, but *gaddi* shows more white on the tail and inner primaries.

As the three races are very close to one another, they are summarized below. Five adult males in comparative seasonal plumage are used. The bill length, taken from the skull, is given, as this measurement is mentioned by various authors. The black terminal spot is that of the fifth inner pair of rectrices and is measured, on whichever side it is greater, to the tip of the feather.

1. *Montifringilla nivalis alpicola* Pallas (Iran, Karaj, January 18). Darker and grayer than *M. n. gaddi*.

MEASUREMENTS: Wing: 117, 119, 120, 121, 122 (119.80); bill: 16, 16, 16, 16, 17.5 (16.30); terminal spot: 9, 10, 10, 11, 11 (10.20).

2. *Montifringilla nivalis gaddi* Zarudny and Loudon (Luristan, Durud, four, and Bakhtiari, Ti, one, January 24–February 14). Paler and more rufous than *M. n. alpicola*.

MEASUREMENTS: Wing: 116, 118, 119, 122, 122.5 (119.50); bill: 15.5, 15.5, 16, 16, 16.5 (15.90); terminal spot: 4, 5, 6, 6, 7 (5.60).

3. *Montifringilla nivalis groum-grzimaili* Zarudny and Loudon (Tian-Shan, Naryn, January 14–16). Color as in *M. n. gaddi*.

MEASUREMENTS: Wing: 115, 118, 120, 121, 124 (119.60); bill: 15, 15, 15.5, 16, 16.5 (15.60); terminal spot: 8, 9, 9, 11, 12 (9.80).

The measurements of the specimens (adults only) collected by Koelz are as follows (specimens from Afghanistan not included):

Montifringilla n. alpicola: Wing: 10 males, 117.0–122.0 (118.90); four females, 110.0–115.0 (112.0). Tail: seven males, 66.0–71.0 (68.92); three females, 62, 66, 72 (66.0). Bill, from skull: 10 males, 16.0–17.5 (16.35); four females, 15.0–16.5 (15.88).

Montifringilla n. gaddi: Wing: 19 males, 116.0–126.0 (119.34); four females, 112.0–116.0 (114.25). Tail: 18 males, 68.0–76.0 (71.50); five females, 65.0–71.0 (68.50). Bill: 18 males, 15.0–17.5 (16.20); five females, 15.0–16.0 (15.60).

The specimens from Afghanistan have not been used for comparison. They are similar in coloration to *gaddi* and *groumgrzimaili*, but in one of the three adult males from Afghanistan the white area on the primary coverts is more restricted, and in the other two it is very much reduced and so much suffused with dark as to be almost lacking.

The reduction in the white area may be characteristic of the birds of Afghanistan, as it is shown by all my specimens, but as it also occurs in an occasional specimen of all the other three races, I think it best, for lack of more material, to refer my Afghanistan specimens to *gaddi*.

Montifringilla nivalis alpicola Pallas

AZERBAIJAN: Livan, November 18, 1940, 1 ad. ♀. Iran: Karaj, January 18, 1945, 6 ad. ♂, 1 ad. ♀, 3 unsexed ad. Mazenderan: Shah Kuh, July 18–19, 1940, 4 ad. ♂, 5 imm. ♂, 2 ad. ♀.

Montifringilla nivalis gaddi Zarudny and Loudon

LURISTAN: Durud, January 22–25, 1941, 5 ad. ♂, March 15–22, 7 ad. ♂, 3 ad. ♀, August 28, 1 imm. ♂, October 25, 1 ad. ♂, 1 ad. ♀; Khali Kuh, June 1, 1940, 4 ad. ♂, 1 imm. ♂, 1 ad. ♀, 2 imm. ♀. Bakhtiari: Ti, February 9–14, 1941, 2 ad. ♂.

AFGHANISTAN: Shanbashak, August 31, 1939, 2 imm. ♀; Safedsang, September 20, 1 imm. ♂; Burchao Pass, October 10–12, 3 ad. ♂, 1 ad. ♀.

Montifringilla adamsi adamsi Adams

KASHMIR: Ladakh, Shakrot, September 26, 1936, 1 imm. ♀.

This immature specimen measures: wing 95.0, tail 52.0, bill 12.5. According to Stuart Baker (1926, Fauna of British India, vol. 3, p. 187), adults measure: wing 102.0–103.0, tail 61.0–70.0, bill 12.0–14.0.

Montifringilla theresae Meinertzhagen

NORTHERN AFGHANISTAN: Sabz Pass, August 28, 1939, 4 ad. ♂, 4 ad. ♀.

All the specimens are in full moult. In the only specimen in which the wing could be measured, an adult female, the length is 88.0. The length of the bill is, in males, 14.0–15.0, and that of females 13.0–15.0. The wing length of Meinertzhagen's specimens was: five males, 93.0–99.0; two females, 89.0 and 91.0.

When discovered, *M. theresae* was found to be breeding on top of the Shibar Pass in northern Afghanistan in company with a *M. nivalis* said by Meinertzhagen to have been *M. nivalis adamsi*. Stegmann (1932, Jour. Ornith., vol. 80, p. 99) has shown that *M. nivalis* and *M. adamsi* are two distinct species. The range of *M. adamsi* does not extend so far west as Afghanistan, and in Meinertzhagen's subsequent report on the birds of northern Afghanistan (1938, Ibis, p. 505), the *M. nivalis* in whose company *theresae* was breeding is identified as *M. n. alpicola*. I have shown in the discussion of *M. n. gaddi* that *alpicola* does not extend to northern Afghanistan, but that the *M. nivalis* of that region seems to belong to another form, which may or may not be distinct from *gaddi*, but in any case is not *alpicola*.

In size and in the pattern of the wing and tail, *M. theresae* belongs in a group made up, in addition to itself, of *M. ruficollis* and *M. blanfordi*. This group differs from the larger *M. nivalis* and *M. adamsi* by a different distribution and much larger amount of dark on the secondaries and rectrices.

In *nivalis* and *adamsi*, the outer rectrices are all white except for small dark tips. All the secondaries in *nivalis* are all white; in *adamsi* only the distal half of the two or three innermost are white, the outermost being white on the inner web and dark on the outer. In *theresae*, *ruficollis*, and *blanfordi* the amount of white varies in each, but all the secondaries on both webs are either dark or end in dark tips, and the rectrices are largely suffused with gray and end in very large dark tips, separated by a narrow or wide white band.

Based on a progressive reduction of white, the order of the species within the two groups appears to be as follows:

Group with much white, larger body size:

1. *M. nivalis*
2. *M. adamsi*

Group with little white, smaller body size:

1. *M. ruficollis*
2. *M. theresae*
3. *M. blanfordi*

Montifringilla blanfordi blanfordi Hume

KASHMIR: Rupshu, Tozeri, October 2–3, 1936, 20 ad. ♂, 2 imm. ♂, 11 ad. ♀, 4 imm. ♀. Northern Punjab: Lahul, Seschu, October 6, 1 ad. ♂.

Four of the adults have just finished moulting, and in the others the moult is just being completed. The immatures are just starting to moult into adult plumage. All the adults are therefore in very fresh plumage. When compared with two worn specimens collected on June 28 at Iso Kor, Rupshu, these June birds have the chin and forehead mark a little blacker than the fresh specimens and are also a little grayer above and below.

The measurements, in adult specimens that have finished moulting or in those in which the feathers used for measurements appear to be fully grown, are as follows: wing, 12 males, 95.0–101.0 (97.66), eight females, 94.0–97.0 (95.30); tail, 12 males, 49.0–55.0 (51.67), nine females, 45.0–50.0 (48.45); bill, 20 males, 10.0–12.0 (10.90), 11 females, 10.0–11.5 (10.95).

The range of *M. b. blanfordi* is southern Tibet and the Himalayas from Kashmir to Sikkim. Two additional races have been described, both from northeastern Tibet: one, *M. b. barbata* Przewalski, 1887, from northwestern China (Kansu) to southern Kuku Nor, east of Zaidam; the other, *M. b. ventorum* Stegmann, 1932, from the "Valley of the Winds" in the Tschamen-tagh, west of Zaidam. Neither is available for examination; *barbata* is said to be grayer above and to lack the rusty tinge of *blanfordi*, and *ventorum* is said to be paler gray above and more yellowish clay than *barbata*.

Ploceus philippinus philippinus Linnaeus

PUNJAB. Lahore, February 11, 1933, 1 ad. ♂. Nepal: Thankot, April 11, 1947, 1 ad. ♂, June 27–July 25, 10 ad. ♂, 1 ad. ♀. United Provinces: Benares, January 22–24, 1947, 2 ad. ♂, 1 ad. ♀; Nichlaul, February 1–6, 4 ad. ♂, 3 ad. ♀; Kalnahi, February 18, 1 ad. ♂, 1 ad. ♀; Lucknow, December 11, 1 ad. ♂. Bihar: Muhammadganj, August 21–September 2, 1947, 8 ad. ♂, 2 ad. ♀; Garhwa Road, September 15, 1 imm. ♂. Surguja: Ramanujganj, November 7, 1947, 1 imm. ♂, 1 imm. ♀. Southern Bengal: Dacca, January 13–17, 1937, 2 ad. ♂, 2 ad. ♀. Central Provinces: Bheraghat, March 1–26, 1946, 6 ad. ♂, 1 ad. ♀, April 26–May 27, 2 ad. ♂, 2 ad. ♀, December 29, 1 imm. ♀; Mandla, June 21, 1 ad. ♂, October 14, 2 ad. ♂, 1 imm. ♂.

The specimens show that this form undergoes two moults a year, a prenuptial and a postnuptial moult. The prenuptial moult is partial; only the feathers of the upper part of the body are renewed, producing in the male the yellow and dark feathers of the breeding season. In the postnuptial moult every feather of the body is changed; the males lose all the colored feathers, and in this eclipse plumage are identical with the females.

The prenuptial moult takes place in the spring. In my specimens from Bheraghat in northern Central Provinces, collected from March 1 to May 27, the first evidence of this moult is on a specimen collected on April 26. In the specimens from Thankot in Nepal, a male from April 11 has not started the moult, but in the rest of the series collected from June 27 to July 25 all the males are in full breeding plumage, with the exception of four June birds in which the moult is from one-half to two-thirds complete. All the Thankot birds, excepting the one from April, are marked "breeding" on the label. Farther south, at Muhammadganj in Bihar, a series collected from August 21 to September 2 is also in full breeding plumage. Throughout the breeding season the whole plumage, with the exception of the nuptial feathers, is very badly worn, and the color of the bill in the males is black.

The height of the breeding season appears to be July and August. It may extend into September, though I believe that the postnuptial moult probably begins towards the end of that month or in the beginning of October. Unfortunately, I have only one adult specimen from September 2 to December 11. In this specimen, collected on October 14 at Mandla, northern Central Provinces, the yellow feathers have almost completely been replaced, but the rest of the plumage, though exceedingly worn, has not begun to moult. I have four immature specimens collected during this season (September 15 to October 14) in Bihar and northern Central Provinces. These, three males and one female, are in fresh juvenal plumage, both sexes are identical, and their color, both above and below, is very tawny.

The wing and tail feathers are the last to be replaced, for in my only two specimens in which the wing is moulting (January 19, Londa, and January 24, Benares), the rest of the body plumage has been completely renewed and, though still very fresh, is beginning to show slight signs of wear. The whole plumage is at its freshest from the middle of December to the middle of February and wears progressively from then onward.

A color comparison made with specimens in fresh or slightly worn plumage shows that the birds from western India are paler, grayer, and less tawny than the birds of eastern and southern India. The palest and least tawny specimen is from Lahore, and the darkest and tawniest are a single specimen from Londa in southern Bombay and several from Dacca in southern Bengal. In the intervening region the birds are intermediate: specimens from Bheraghat in northern Central Provinces; Kheri, Kalnahi, and Nichlaul in northern United Provinces; and Thankot in Nepal are closer to the pale bird from Lahore, while the specimens from Lucknow and Benares are quite close to the birds of Dacca. This trend is definite, although I have too few specimens to be able to express it numerically. As Whistler mentions (1933, Jour. Bombay Nat. Hist. Soc., vol. 36, p. 832), the birds from Benares eastward to Dacca will probably be found to intergrade with the tawnier race (*Ploceus philippinus burmanicus*) of the eastern Himalayas, Assam, and northern and central Burma.

MEASUREMENTS: (Fresh or slightly worn adult specimens only.) Wing: 13 males, 70.0–77.0 (73.0); six females, 71.0–73.0 (71.84). Tail: 13 males, 43.0–52.0 (46.34); six females, 43.0–48.0 (45.0). Bill: all adults, 41 males, 17.0–19.5 (17.94); 13 females, 16.5–18.5 (17.50).

Ploceus philippinus travancoreensis Whistler

SOUTHERN BOMBAY PRESIDENCY: Londa, January 18, 1938, 1 ad. ♂.

The single specimen from Londa, mentioned above, is identical in the coloration of the upper parts with the specimens from Dacca, but the under surface of the body is darker. The tawny wash is more pronounced, its shaft streaks are darker and better defined, and the wash covers the whole abdomen instead of being limited to the breast and flanks as in all my other specimens of *philippinus*. These characters match exactly those given in the description of *Ploceus philippinus travancoreensis*. This new race was described by Whistler from breeding specimens collected at Kottayam on the backwaters of the Travancore coast below Cochin (1936, *in* Ali, Jour. Bombay Nat. Hist. Soc., vol. 38, p. 504). This new specimen from Londa extends considerably the range of *P. p. travancoreensis* along the west coast of India.

The distribution of the dark forms of *P. philippinus* (*P. p. travancoreensis* and *P. p. birmanicus*) is reminiscent of the distribution of the Great Indian Hornbill (*Dichoceros bicornis*) and that of the Frogmouths of the genus *Batrachostomus*, as illustrated by the maps of Ali (1935, Jour. Bombay Nat. Hist. Soc., vol. 37, p. 823).

MEASUREMENTS: Londa: adult male: wing, 72; tail, 42; bill, 17.5. Kottayam (Ali and Whistler): four adult males: wing, 70–75; tail, 41.5–48.0; bill, 18–20. One adult female: wing, 72.5; tail, moult; bill, 20.

Ploceus manyar flaviceps Lesson

PUNJAB: Keshapur, March 7, 1931, 1 ad. ♂. Sind: Khinjar Lake, February 4, 1934, 1 ad. ♂.

These two specimens and two others also from Keshapur, collected at the same time as my specimens, constitute all the material available to me. Since these four specimens were collected not long after the complete postnuptial moult, they are in fresh or slightly worn plumage. The four specimens are identical above, but below they are somewhat different. The three Punjab birds are paler, less heavily streaked, and the shaft steaks are narrower than in the specimen from Sind. These are exactly the characters given by S. Baker as distinguishing *P. manyar striatus* from *P. manyar flaviceps* (1926, Fauna of British India, vol. 3, p. 73). However, in view of the slightness of the differences, additional material is required before *striatus* can be recognized as a valid form.

MEASUREMENTS: Punjab, Keshapur: two adult males: wing, 69, 72; tail, 44.5, 45.5; bill, 19, 19.5. One female: wing, 65; tail, 42; bill, 18. Sind, Khinjar Lake: one adult male: wing, 74; tail, 45.5; bill, 19.

Ploceus benghalensis Linnaeus

NORTHERN UNITED PROVINCES: Nichlaul, February 13, 1947, 1 ad. ♀: Kalnahi, February 24, 2 ad. ♂.

These three specimens are in fresh, or slightly worn, winter plumage. Both sexes are identical.

MEASUREMENTS: Wing: male, 70.5, 73; female, 71. Tail: male, 42, 44; female, 44. Bill: male, 16, 16.5; female, 16.

Lonchura malabarica malabarica Linnaeus

SOUTHERN PERSIA: Laristan, Isin, December 17–18, 1939, 2 ad. ♂, 2 ad. ♀. INDIA: Sind: Soneri Lake, December 5–7, 1939, 1 ad. ♂, 1 ad. ♀. Northern Punjab: Kangra, Kotla, February 3, 1946, 1 ad. ♂. United Provinces. Lucknow, December 10–11, 1936, 2 ad. ♂, 1 ad. ♀; Siswa Bazar, January 30, 1947, 1 ad. ♀; Nichlaul, January 31, 1 ad. ♂; Kalnahi, February 15, 2 ad. ♂. Bihar: Bhagahaghat, February 28, 1947, 1 ad. ♀; Muhammadganj, August 22–September 3, 5 ad. ♂, 2 ad. ♀. Central Provinces: Bheraghat, March 11–May 10, 1946, 3 ad ♂, 2 imm. ♂, 5 ad. ♀, 1 imm. ♀. Madras Presidency: Rati, January 29, 1937, 1 ad. ♂; Sidhout, March 22, 1 ad. ♂; Hospet, March 25, 1 ad. ♂.

This is one of the Indian species whose range extends into southeastern and southern Persia. Ticehurst (1925, Jour. Bombay Nat. Hist. Soc., vol. 30, p. 728) reports a specimen collected on April 7, 1921, on Tanb Island at the eastern end of the Persian Gulf. As most of the island is barren, this specimen, which was the only one seen, is believed to have been a stray. My specimens from Laristan were collected at Isin, 9 miles north of Bandar Abbas, and represent so far the most western record of the species on the mainland.

These four specimens are slightly paler than specimens from India in comparative plumage. The primaries and rectrices are not so dark, brownish rather than blackish, and the rusty edges on the upper surface of the central rectrices are broader. These feathers also appear to be slightly shorter, less pointed, more rounded at their tips than in the Indian specimens. However, this last character may not be reliable, as the shape of the tips of these feathers varies in the Indian specimens, and the soft thin point of the feather is quickly worn off.

My material from Persia is insufficient, but the differences between these specimens and those of India, though slight, deserved to be mentioned. In the rest of the series from the various parts of India I can see no difference in coloration between birds in comparative plumage, and there are no significant size differences, as can be seen below.

MEASUREMENTS: (Fresh or slightly worn adult specimens only.)

Persia: Tail: male, 43, 46; female, 46, 49. Wing: male, 55, 57; female, 55, 56.

Sind: Tail: male, 45. Wing: male, 55; female, 55.5.

United Provinces: Tail: male, 51. Wing: male, 55.

Bihar: Tail. male, 47, 47, 48, 48, 50; female, 54, 57. Wing: male, 54, 54, 54.5, 55, 56; female, 54, 57.

Central Provinces: Tail: male, 45; female, 45, 46. Wing: female, 56, 56.

Madras: Tail: male, 51. Wing: male, 56.

Bill length: Persia: male, 10, 11; female, 10, 11. India: 18 males, 10.0–11.0 (10.25); 11 females, 10.0–11.0 (10.18).

Lonchura striata acuticauda Hodgson

NEPAL: Hetora, May 13, 1947, 1 ad. ♂.

This form differs from the more southern race, *striata* (type locality, Ceylon), by being browner, by being marked with fine blackish squamations on the abdomen and flanks, and by having more prominent shaft streaks. In *striata*, the feathers of the throat and upper breast are pure black, whereas in *acuticauda* (type locality, Nepal) these feathers are brown, end in rufous edges, and are marked with fine shaft streaks.

This specimen is in very worn condition, and the feathers of the throat and top of the head are moulting.

Lonchura striata striata Linnaeus

SYNONYM: *Lonchura striata estriata* Koelz.

NORTHERN MADRAS PRESIDENCY. Mahendra, January 25–26, 1937, 1 ad. ♂, 1 imm. ♂, 1 imm. ♀. Southern Madras Presidency: Nilghiri Hills, Kunjapanai, February 20, 1 imm. ♀; Nilambur, March 2, 1 ad. ♀. Southern Bombay Presidency: Londa, January 7–February 14, 1938, 3 ad. ♂, 5 ad. ♀, 1 imm. ♀; Jagalbed, February 22–24, 1 ad. ♂, 1 ad. ♀, 1 ad. ♀ (the type of *L. s. estriata*). Northern Central Provinces: Belwani-Kisli, August 2–8, 1946, 1 ad. ♂, 2 ad. ♀, 2 unsexed ad., September 25, 3 ad. ♂; Bichhia, August 7, 1 ad. ♀.

Lonchura s. estriata is based on the series from Londa and Jagalbed in southern Bombay and the specimen from Nilambur. In the type and two or three of the other specimens the shaft streaks are to a varying degree less prominent than in the typical specimens of *striata* from Ceylon in the Rothschild collection. The black of the southern Bombay specimens is a little more intense and the white is purer than in the Ceylon specimens, but these are old foxed skins dating from 1875 and 1893. In four fresh specimens collected in December, 1939, at Seringapatam in Mysore by Ali, the coloration is identical to that of the southern Bombay birds. The shaft streaks of the Mysore birds are as well marked as in the Ceylon specimens. The Mysore birds are identical to my good series from the central Northern Provinces. Whistler (1942, Jour. Bombay Nat. Hist. Soc., vol. 43, p. 36) found that the specimens in the British Museum from southern India, including some to the north and south of the type locality of *estriata*, could not be separated from typical *striata* of Ceylon. Though the population in the Londa neighborhood shows a tendency towards a reduction in the prominence in the shaft streaks, the specimens from this series cannot be separated as a whole from my other specimens from southern India and Ceylon.

The adult specimen from Mahendra confirms Whistler's observation (1933, Jour. Bombay Nat. Hist. Soc., vol. 36, p. 834) that the birds from the northern end of the Eastern Ghats are intermediate between *acuticauda* and *striata*. This specimen is browner on the back, ear coverts, and shorter upper tail coverts, and has more prominent shaft streaks on its back than in *striata*. Below, although its appearance is closer to that of *striata*, it shows very faint shaft streaks on the throat and traces of blackish squamation on the flanks and lower abdomen.

Breeding birds can be found at different seasons of the year. In my series, specimens collected while breeding were taken at Londa in southern Bombay from January 31 to February 11, and on September 25 at Belwani-Kisli in northern Central Provinces. The moult follows the breeding season but can start apparently while the birds are still breeding. The wing moults first and is followed by the crown and upper throat. All of the specimens from southern Bombay and the one from southern Madras collected from January 7 to March 2 and the birds from Central Provinces collected from August 2 to September 25 are in worn plumage. In one-third to one-half of the specimens from both regions (including the breeding birds in both cases) the moult has started with the feathers of the wing, while that of the rest of the body, with the exception of a few feathers on the crown and upper throat, has not begun. At Mahendra, on January 25, an immature specimen is moulting into the adult plumage.

MEASUREMENTS: (Badly worn specimens are not included.) Wing: five males, 53.0–55.0 (54.20); seven females, 52.0–54.5 (53.14). Tail: five males, 39.0–45.0 (41.50); four females, 38.0–41.5 (40.25). Bill (all adults): nine males, 12.0–13.0 (12.27); 10 females, 12.0–13.0 (12.45).

Lonchura ferruginosa atricapilla Vieillot

SYNONYM: *Munia rubroniger* Hodgson.
NEPAL: Hetora, August 1, 1947, 1 ad. ♀.

The birds of Nepal were called *Munia rubroniger* by Hodgson in 1836, but the older name of this form is *Loxia atricapilla* Vieillot, 1805, the type locality of which was restricted to lower Bengal by Robinson and Kloss (1924, Jour. Nat. Hist. Soc. Siam, vol. 5, p. 362). The measurements given by these authors show that there is no difference in size between the birds of Nepal (wing length of 12 specimens, 53–56), and those of peninsular Siam (seven specimens, 52–56). My specimens from the collection of the American Museum of Natural History, from Nepal, measure 55, 55, 56 (55.33), and 13 others from the intervening regions between Nepal and peninsular Siam, 54–57 (54.96). My specimens also show that the amount of black on the abdomen varies individually, a fact already noticed by Chasen and Kloss in their specimens from the north of the Malay Peninsula (1929, Bull. Raffles Mus., no. 2, p. 23).

The specimen collected at Hetora on August 1 was in the act of laying. Its plumage is quite worn.

Lonchura punctulata lineoventer Hodgson

NORTHERN PUNJAB: Kangra: Kangra, November 22–23, 1936, 1 ad. ♂, 2 ad. ♀; Kotla, January 26–27, 1946, 1 imm. ♂, 1 imm. ♀. Nepal: Amlekhganj, March 6, 1947, 1 imm. ♀; Thankot, March 30, 1 imm. ♂; Hetora, June 13–July 6, 2 ad. ♂, 6 ad. ♀. United Provinces: Lucknow, December 11, 1936, 1 ad. ♂, 1 ad. ♀; Siswa Bazar, January 30, 1947, 1 ad. ♂, 1 imm. ♂; Nichlaul, February 1–7, 2 imm. ♂, 2 ad. ♀, 1 imm ♀; Kalnahi, February 20, 1 ad. ♀, November 19, 1 imm. ♂; Khada, February 27, 1 unsexed ad. Southern Bengal: Dacca, January 13–16, 1937, 2 ad. ♀. Bihar: Garhwa Road, September 15, 1947, 1 ad. ♀. Surguja: Ramanujganj, October 7–November 9, 1947, 3 ad. ♂, 2 imm. ♂, 1 imm. ♀; Gargori, October 20, 1 ad. ♀. Central Provinces: Bheraghat, March 24–April 26, 1946, 3 ad. ♂, 1 ad. ♀ ?; Kanha, August 11–September 5, 4 ad. ♂, 3 ad. ♀; Belwani-Kisli, August 31, 1 ad. ♂, September 24, 1 ad. ♀. Southern Bombay Presidency: Londa, January 7–February 18, 1938, 5 ad. ♂, 3 imm. ♂, 4 ad. ♀, 4 imm. ♀; Jagalbed, February 18–23, 1 ad. ♂, 2 imm. ♂, 1 ad. ♀.

As shown by Ticehurst (1937, Jour. Bombay Nat. Hist. Soc., vol. 39, p. 557), the correct name of this form is *lineoventer* Hodgson, 1836 (type locality, Nepal), and not *punctulata* Linnaeus, 1766, the type locality of which had been fixed as Java in 1789.

The series includes specimens from every month of the year except May. Comparison of the specimens in fresh or not too badly worn plumage fails to show any color difference between birds from northern Punjab, Nepal, United Provinces, Bihar, and Central Provinces. The specimens from southern Bengal and southern Bombay are in the last stages of wear and are not comparable. The males average a little darker than the females, both above and below. In the females, the crown and mantle are grayer, the maroon color of the throat is not so rich, and the edges of the feathers of the breast and flank are a little browner. There are no size differences between my specimens of the various populations.

The plumage is renewed by a complete postnuptial moult, and there is no eclipse plumage. Unfortunately, no notes were recorded as to the breeding condition, with the exception of two specimens collected in the act of laying at Kanha on August 15, and September 24 at Belwani-Kisli, both localities in northern Central Provinces. The breeding season probably varies in different parts of India, as specimens in various stages of moult are found from the end of November to the end of April. In my specimens, birds taken from August 11 to October 20 are in worn plumage and show no evidence of moult. These specimens, which include the two breeding birds, were collected in Bihar, Surguja, and northern Central Provinces. The first evidences of moult are in birds taken at the end of November in northern Punjab, the moult starting with the secondaries and inner primaries. At Dacca in southern Bengal, a bird from January 16 has not started to moult, but in another taken on January 13 the moult is starting with the secondaries. Birds from December 11 to February 7 in United Provinces, January 27 to February 23 in southern Bombay, and March 24 to April 26 from Bheraghat in northern Central Provinces are in the midst of the moult, the wing feathers and body plumage moulting simultaneously. During this season, immature specimens from United Provinces and southern Bombay are moulting into adult plumage, the first adult feathers appearing on the throat, breast, and flanks. In my specimens the only adults in really fresh plumage are June and early July birds from Nepal.

Measurements: (Badly worn specimens are excepted.) Wing: 10 males, 54.0–57.5 (55.65); 15 females, 53.0–58.0 (55.33). Tail: six males, 40.0–45.0 (42.60); seven females, 38.0–45.0 (40.50). Bill (all adults): 23 males, 11.0–12.5 (12.0); 24 females, 11.0–12.5 (11.85).

Estrilda amandava amandava Linnaeus

UNITED PROVINCES: Saharanpur, December 1, 1936, 2 ad. ♂; Nichlaul, February 4–14, 1947, 1 ad. ♂, 2 imm. ♂; Kalnahi, February 17–24, 2 ad. ♂, 1 imm. ♂, 1 ad. ♀, 1 imm. ♀. Central Provinces: Bheraghat, April 22–May 2, 1946, 2 ad. ♂, 2 imm. ♂, 6 ad. ♀, December 5–21, 1 ad. ♂, 1 ad. ♀, 2 imm. ♀; Belwani-Kisli, July 26, 2 ad. ♂, 2 ad. ♀, September 25–29, 4 ad. ♂; Bichhia, July 5–15, 3 ad. ♂, October 5, 1 ad. ♂; Kanha, September 16, 1 ad. ♂.

The races of this species have been illustrated in color and have been discussed in detail by Delacour (1935, L'Oiseau, p. 377). The nominate race is found throughout India, Ceylon, and Assam.

This series gives a good illustration of the moult. As is well known, the adult male in this species assumes the brown plumage of the female after the breeding season and reverts again to the red plumage preparatory to the breeding season. My specimens show that this prenuptial moult is a complete moult, and that the postnuptial moult is partial and involves only the replacement of the red feathers.

In my specimens, two adult males collected on February 4 and 17 in United Provinces are well advanced or have turned completely into the eclipse plumage, but their wing and tail show no signs of moult. In Central Provinces, birds of both sexes collected from April 22 to July 26 are in full moult, the moult of the wing and tail feathers being far more advanced than that of the body plumage. Examination of these specimens shows that on April 22 an adult male is moulting the wing and tail but that there are no signs of any red feathers. In another from July 7 the moult of the tail has been completed and that of the wing is far advanced, but only a few pin points of red feathers, appearing on the crown and face, are breaking through their sheaths. This is also true of four other adult male specimens collected from July 5 to 26. In these the moult of the tail has been completed and that of the wing is advanced but that of the body feathers is lagging behind to a varying degree. Two immature males, also from April 22, are moulting into adult plumage, the first adult feathers appearing in the wing in one case and in the wing and tail in the other. From September 16 to December 5 in Central Provinces, and December 1 in United Provinces, all my adult specimens are in the full red breeding plumage, the intensity of the red varying somewhat individually. Following the breeding season I have no specimens from Central Provinces between December 5 and April 22, but, as mentioned above, two adult males taken in early February in United Provinces are turning or have turned into the eclipse plumage.

MEASUREMENTS: (Badly worn specimens or specimens in which the feather is not fully grown are excepted.) Wing: 13 males, 47.0–50.5 (48.30); four females, 47.0–48.0 (47.60). Tail: 15 males, 36.0–41.0 (37.73); four females, 35.0–38.0 (36.50). Bill (all adults): 18 males, 10.0–10.5 (10.20); 10 females, 9.5–10.5 (10.04).

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A REPORT ON SOME MIOCENE DIPTERA FROM FLORISSANT, COLORADO

By Axel Leonard Melander[1]

Florissant, Colorado, is justly famous for the multitude of fossils that have been discovered there. In Miocene times the region was the scene of intense volcanic activity. Subterranean explosions now and again showered poisonous fumes and fine ashes on the creatures of the area to overwhelm and bury them. Outbursts of molten lava descending on shallow Lake Florissant and the adjacent swamps boiled the water and baked the silt into shale. Ants and beetles crawling over the marshland were entombed. Insects flying over the water instantaneously perished, dropping to the surface, and then were carried down by the cloud of volcanic dust falling upon them. As they lay sprawled out, some flat, others on their side, many left an imprint in the accumulating silt. Perhaps the sulphurous gases preserved them from immediate decay, or their bodies were sterilized in the boiling water, which might account for the astounding number of fossilized specimens now being uncovered in this locality.

It is interesting to note that frequently the expanded abdomens of the fossils, evidenced by the wide interstices between the sclerites, suggest an internal bloating while the insects were being encased in the drying mud, as if they had been boiled. In Yellowstone National Park, insects can be seen to drop in their flight over the fumaroles and hot pools. Their bodies when seen in the water show a similar puffing of the abdominal segments. Were they to be covered with ashes they might easily duplicate the conditions at this Miocene fossil bed. The prevalence of

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Chironomidae, Bibionidae, and Empididae in the Florissant beds might even time most of the cataclysms as having occurred in the spring of the year.

As layer upon layer of volcanic ash accumulated, with alternate inundations and desiccations of the lake bed, the strata flattened by their own weight. The fossilized insects, fish, and plants were crushed to an infinitesimal thinness, sometimes leaving a carbonized deposit like a silhouette, or else an imponderable print like a photographic image, often with an iridescent sheen, especially on the abdomen. The shale rock thus formed can now be readily split into thin lamellae. Most of the disclosures naturally are devoid of fossils, but the thousands of specimens of insects that have been discovered in this limited area attest an extraordinary abundance and variety of insect life in that far-gone time.

When insects are collected in any locality it is commonly noticed that some species are abundant in individuals and others are rare. It is not strange, therefore, that many of the Florissant Miocene species are represented by single specimens. Some forms, like *Chironomus* and *Bibio*, evidently perished in swarms, but the large number of uniques in the collection suggests a rich fauna still to be encountered.

It is of interest to note that heretofore 167 species of Diptera have been described from Florissant, of which Cockerell contributed 85, Scudder 53, of which 51 are Tipulidae, James 12, Hull 11, Melander three, Brues two, and Johannsen one. The present study adds 62 new species, besides recognizing 22 of the previously described species. Three of the species have been placed in new genera, the significant point of which is not that three genera have become extinct, but that 55 of the new species can be assigned to genera persisting today. In addition to the material reported on, the collection contains some more species which are represented by specimens too imperfect for accurate determination.

While many of the Florissant fossils are wonderfully preserved, sometimes with the microscopic hairs as plainly visible as in existing species, the vast majority are imperfect or fragmentary in some respect or other. Too often some important taxonomic structure is obliterated, which complicates the placement of the specimen. By tilting the stone at different angles under the binocular microscope and varying the direction of spot-light illumination it is surprising how often illusive venational characters can be brought into view. Sometimes moistening the stone will afford for a brief time a greater contrast between the specimen and the matrix. Specimens mounted under Canada balsam and a cover glass show to advantage, a treatment especially desirable when certain shales slake and flake off.

When the collector separates the laminae of shale and a specimen is found, usually most of the insect, as far as it is preserved, is disclosed at once. Outlying parts, like antennae, tarsi, and the tips of the wings, may still remain hidden because the stone did not fracture properly. A mounted needle, ground to a microchisel end, is then useful to dissect off the bits of shale and often can expose important structures. It affords one a deep feeling of veneration to watch under the microscope the uncovering of structures entombed 10 million years ago.

For the Florissant Diptera there has been surprisingly little evolutionary change since the Miocene. Wing patterns conform in nearly every instance to those of present-day genera. Most of the species can be rated in terms of the modern fauna. Sometimes even the species present no special difference from certain living forms. Such fixation of structure seems remarkable when we consider the innumerable generations that have elapsed since the time when the Florissant specimens were laid away. Evolutionary development of genera and species took place long before Miocene times.

But in identifying the members of the collection under study not every individual affords worth-while information. Some structures, like setae, pubescence, or weak veins, rarely are completely preserved. If the insect died with the two wings overlapping it may be difficult to discriminate between the veins. When flattened to a single plane the dorsal and ventral structures are superposed. If parts of the insect were at an angle to the plane of fossilization measurements may become deceptive, for example, when one apparently short femur projected upward and its normal mate was outspread. There might even have been some distortion as the sediment became impacted. This is sometimes noticeable in disagreements when micrometrically measuring the cells of the two wings. Previously was mentioned the frequent puffing out of the abdomen which would make the body measure longer than it was before death.

Since the fossils in the shales, unlike those in amber, lack many details of structure, their descriptions of necessity are brief. Measurements with the micrometer are presented, as a matter of record, but it is realized that such exactness is more a description of the fossil specimen than of the species. When measurements of a curved line are given the size is the straight-line distance between the designated points. It has been the custom to include the extent of fasciation of the abdomen in the diagnoses of species, though the dark and light alternate banding may represent individual bloating rather than the original color pattern.

The present study considers the Diptera collected by the American Museum of Natural History expedition to Florissant, Colorado, in 1906 (the references indicated by A.M.N.H.), together with some material from the R. D. Lacoe collection belonging to the United States National Museum (designated hereafter as U.S.N.M.), supplemented by a few specimens from the British Museum (Natural History) and one from the University of Colorado. The National Museum material was collected at Florissant and bears various lot numbers. Dr. R. S. Bassler, Head Curator of the Department of Geology, states that the lot numbers do not indicate localities or strata at Florissant, but only accessions to the Lacoe collection. Therefore the numbers are not given with the following descriptions.

The specimens belonging to the American Museum of Natural History were found by Professor and Mrs. T. D. A. Cockerell, Professor W. M. Wheeler, and Mr. Sievert A. Rohwer. The exact sites, as marked on most of the specimens by station numbers, have been described by Cockerell in the Bulletin of the American Museum of Natural History (vol. 23, pp. 127–132, 1907). Credit is given the collector where the specimens have been initialed. Probably most of the large number of undesignated specimens were discovered by Professor or Mrs. Cockerell.

For future identification purposes the specimens have been given a study number, inscribed in India ink at the margin of the stone, rather than by affixing labels which might become detached. However, specimens since assigned catalogue numbers by the United States National Museum (U.S.N.M.), the American Museum of Natural History (A.M.N.H.), or the British Museum (Natural History) (Br.M.N.H.) have been referred to, throughout the present report, by these catalogue numbers rather than by their original study numbers. The measurements given in the descriptions are in millimeters and fractions of millimeters, unless microns ($^1/_{1000}$ mm.) are indicated. The photographs have been made by a variety of cameras and lenses. Generally, a long bellows and long-focus lens were used, the illumination being variously one or two miniature arc lamps, or an electric bulb spot light, or photo flood lights, the photographs being taken on slow contrast plates. Sometimes to increase contrast and bring out detail the specimen was moistened with glycerine during the long exposure, and sometimes a color filter was used. The enlarged unretouched photographs, it may be stated, are superior to the actual specimens in contrasting the fossil from the matrix. To show the varying degree of magnification the size of the original specimen is given in the captions to the figures.

TIPULIDAE

Tipula wilmatteae, new species

Figure 2

A larva, represented in profile by the posterior six or seven segments, was discovered at Station 14, Florissant, and is provisionally referred to the genus *Tipula.* The body apparently was stoutly terete, somewhat tapering caudally, without tubercles or spines, the posterior end expanding into six subequal anal lobes. No hairs or setae are visible, other than two bristles, one above the other, on the side of the antepenultimate segment. The body is almost colorless, except the last two segments which in the fossil are quite blackish, including the backward projecting processes. A discoloration extends along the lower part of the body, probably indicating the alimentary tract.

Scudder enumerated 51 species of Tipulidae from the Florissant shales, all in the adult condition, and in the collection under study there are upwards of a hundred tipulid flies. The present fossil is the first indicated discovery of a crane-fly larva. The relation of this larva to the adult flies probably can never be ascertained, so the species name will be a permanent recognition of the collaboration of Mrs. Wilmatte Porter Cockerell in assembling the Florissant collection for the American Museum of Natural History.

HOLOTYPE (BY MONOTYPY): A.M.N.H. No. 26452.

Tipula florissanta Scudder

Figure 3

In the Florissant material studied by Scudder, this is the commonest species, represented by 55 specimens. One of his paratypes in the United States National Museum collection before me compares with five specimens from the American Museum and five more from the National Museum. It is quite probable that these are not all the same species, as they come from different strata; of the American Museum lot two specimens (A.M.N.H. No. 26453/1) were collected by Wheeler at Station 14, two others (A.M.N.H. No. 26453/2) by Wheeler at Station 11, and A M.N.H. No. 26453, a hyaline wing on pale gray shale (fig. 3), came from Station 13.

Tipula limi Scudder

A female in the Lacoe collection of the National Museum traces to this species. Its wings show a fainter clouding than Scudder indicated, but the pattern conforms. The wings are on the borderline for size, measuring 19 mm. in length and 5 mm. in width.

Tipula heilprini Scudder

A detached wing, 22 mm. long, from Station 14, A.M.N.H. No. 26454, agrees with the figure in Scudder's "Florissant Tipulidae" in neuration and in showing the stigmatic and preapical clouding. In addition there is a small cloud surrounding the base of the prefurca.

Tipula lapillescens Scudder

A female faintly marked on the shale, from Station 14, Florissant (A.M.N.H. No. 26455:1), is probably this species. It does show a maculation of the wing agreeing with Scudder's figure 3 of plate 9. A dislocated wing from the same station (A.M.N.H. No. 26455:2) has but a faint indication of the wing picture. In both specimens the m-cu cross vein does not quite reach the discal cell, being separated from it by the blunted end of the second basal cell.

Tipula maclurei Scudder

A female from Station 14 (A.M.N.H. No. 26456:1) with darkened abdomen and maculate wings seems to be this species though it is somewhat smaller than the type, the wing measuring about 20 mm. in length. Both halves of the fossil are represented, though the anterior part of the insect is wanting. The specimen was received from Professor C. T. Brues, who discovered the fossil by splitting a bit of shale that showed another insect on a different layer. A dislocated wing (A.M.N.H. No. 26456:2) shows the same color pattern.

Tipulidae distincta Scudder

A well-preserved female in profile in the Lacoe collection (U.S.N.M.) is assignable to this species. The venter is quite dark.

Helius faecarius Scudder

This species, described as *Rhamphidia*, is represented by a well-preserved specimen in obverse and reverse, from Station 13, Florissant (A.M.N.H. No. 26459). The specimen agrees so well with the description and figure that there is no doubt about the identification.

Cladura integra Scudder

A specimen of this species was collected at Florissant (A.M. N.H. No. 26460). The venation of one wing is well preserved and agrees with the description and illustration in Scudder's "Florissant Tipulidae."

Cyttaromyia clathrata Scudder

One specimen in the Lacoe collection (U.S.N.M.) shows the characteristic neuration of this genus, with the first posterior cell divided to form an extra cell above the discal cell. It keys to *C. clathrata*, though it is slightly larger than Scudder's specimens.

Limnoscema marcescens Scudder

A female specimen found at Florissant Station 14 (A.M.N.H. No. 26461) agrees well with the figure and description given by Scudder. The cross veins are obliterated so the wings appear to possess only longitudinal veins. Abdominal incisures strongly marked.

MYCETOPHILIDAE

Boletina hypogaea, new species

Figure 10

Length 5.1 mm. Head and mesonotum black, pleura probably brownish, abdomen as preserved iridescent piceous, greatly distended, with the membrane colorless between the sclerites. Antennae scarcely twice the head height, rather stout, proboscis not projecting. Legs long and slender, light brown. Bristles of body not preserved; the apical spurs of tibiae strong, but no extensor tibial spines showing. Wings 3.75 by 1.45 mm., quite strongly and uniformly infumated, overlapping but not coinciding, the venation therefore confused, auxiliary vein 1.2 mm. long and ending in costa, first vein ending 0.75 mm. before level of wing tip, third vein ending before wing tip, prefurca of fourth vein about 0.35, upper branch of fourth vein (M_{1+2}) 2.1 mm.

HOLOTYPE: U.S.N.M. No. 112571 (R. D. Lacoe collection) Miocene shales, Florissant, Colorado.

A beautiful specimen, but the superposition of the wings and lack of somatic bristles preclude exact generic placement. Compared with several existing species of *Boletina* the fossil agrees well. Scudder has described three other species of *Boletina* from the Tertiary of British Columbia and Wyoming.

Hypogaea, Greek *ὑπόγαιος*, from under the earth.

Exechia priscula, new species

Figure 9

Length 5.5 mm.; head 0.6, thorax 1.2, abdomen 3.9; wing 3.3 mm. A light brown species, the humeri and under side of body and the legs paler, wings slightly infumated, with base and apex subhyaline, veins light fuscous. Spurs of hind tibiae long, the extensor setae short. Subcosta very short, ending in the radius, transverse fork of radial sector 1 mm. from humeral cross vein, 1.2 mm. from end of first vein, and 1.6 from end of the nearly straight third vein, r-m cross vein strongly reflexed, 0.25 mm. long, fourth vein between fork and cross vein 0.1 mm., i.e., the fork is before the end of the first basal cell, cubitus forked much beyond medial fork, the anterior branch arched. Middle abdominal segments darker in front than behind.

HOLOTYPE: A.M.N.H. No. 26462, from the Miocene shales at Florissant, Colorado, discovered by William M. Wheeler. Un-questionably the species is to be located in the modern genus *Exechia*.

Priscula, neo-Latin, rather ancient.

PROAPEMON, NEW GENUS

First radius reaching apical third of wing, radial sector forked just beyond end of R_1, the anterior branch forming an acute angle, ending in costa about two-fifths the distance between the tips of R_1 and R_5; no r-m cross vein, the two veins fused for a short distance beyond the first basal cell; base of media weak but dividing the two basal cells and extending to the m-cu cross vein, thence after the fusion with the radial sector forming a short pedicel to the two branches of the media; Cu_1 twice angulate at the end of the second basal cell, Cu_2 distinctly arcuate. Three uniform ocelli widely spaced on a gentle curve; second antennal joint cylindrical, about four times as long as the diameter, microscopically hairy, the joints of at least basal part of flagellum square and bare, but not so sturdy as in *Apemon;* palpi apparently incurved. Legs long and slender; abdomen and femora clothed with rather long hairs, tibiae and tarsi with close-set microscopic hairs, the hind tibiae with some short scattered setulae, as in *Apemon*. The condition of the proboscis and the length of the subcosta cannot be stated.

GENOTYPE: *Proapemon infernus*, the species following.

This fly is closely related to *Hesperodes* and *Apemon* in the Ceroplatinae. Its wings are very similar to the diagrammatic figure of *Hesperodes* given by Johannsen in the "Genera insectorum," fascicle 93, and Bulletin 172 of the Maine Experiment Station. The new genus differs from *Hesperodes* in having three distinct ocelli and a long antennal scape. From *Apemon* it is distinct by having the anterior branch of the third vein, R_{2+3}, ending separately in the costa, a generalized condition, as well as by its lengthened antennal scape.

Proapemon infernus, new species

Figure 5

Length about 6 mm.; thorax 1.6, abdomen 4.5; wing about 4.8 mm. Apparently a testaceous species, mesonotum posteriorly probably with two narrow darker vittae, notopleural suture and sternopleura marked with brown, legs light colored, wings infumated, probably with a stronger but indefinite band across middle third, veins firm and dark, as preserved the right wing nearly colorless but showing most of the veins, while the left wing is dark with only the costa, radius, and media strong. Anterior branch of radial sector 0.45 mm. long, ending 0.45 from tip of R_1, posterior branch 1.5 long, ending near apex of wing and 1.2 from tip of anterior branch, base of radial sector 0.45 long, fusion with media 0.3, petiole of media 0.5, m-cu cross vein 0.1, lower distal angle of second basal cell 0.3. Length of hind tibia 2.1 mm., of hind metatarsus 1.3, remainder of tarsus 1.5.

HOLOTYPE: A.M.N.H. No. 26463, from the Miocene shales, Florissant, Colorado, Station 14.

Proapemon, Greek, coming before *Apemon* (ἀπήμων, doing no harm); *infernus*, Latin, underground.

SCIARIDAE

TABLE OF THE FLORISSANT MIOCENE SPECIES OF *Sciara*

1. Wings infumated, anterior veins brown; thorax piceous, subshining, abdomen light fuscous; legs mostly pale; posterior branch of radius 0.5 mm. longer than the anterior branch.........*requieta*, new species
Wings hyaline or subhyaline, posterior branch of radius more than 0.5 mm. longer than the anterior branch..................................2
2. Length 4.5 mm., wing 3.6, R_1 ending near two-thirds the wing length, ratio of the two branches of radius beyond the apparent cross vein 1:2.17.. ....*florissantensis* Cockerell
Wing not over 3 mm. long, R_1 ending nearer middle of wing, the two branches of radius proportioned about 1:2..................................3
3. Anterior veins fuscous; legs black; end of abdomen conical............ ....*dormitans*, new species
Anterior veins light brown; legs fuscous; end of abdomen tubular....... ....*sopora*, new species

Sciara dormitans, new species

Figure 6

FEMALE: Length 4.2 mm.; abdomen 3; wing about 2.7; hind femur 1.3; hind tibia 1.2. Body and legs blackish, the abdominal sclerites slightly less intense, incisures weak. Wings hyaline, anterior veins thin but strong, posterior veins not evident; anterior branch of radius ending about 1.4 mm. from base of wing or 0.95 beyond apparent cross vein, posterior branch extending 0.85 mm. beyond the anterior branch.

HOLOTYPE: A.M.N.H. No. 26464:1, from the Miocene shales, Florissant, Colorado, Station 13.

Dormitans, Latin, sleeping, as in death.

Sciara requieta, new species

Figure 7

FEMALE: Length 4.2 mm.; abdomen 2 7; wing 3. Abdomen conical posteriorly, not tubular, front legs very pale, hind tarsi darker than their tibiae. Anterior branch of radius 0.85 mm. long measuring from the apparent cross vein, posterior branch 1.35 from the same place, the straight-line distance between the ends of the two branches 0.9, the anterior branch ending at about 1.65 from the base of the wing and 1.35 from the apex, posterior veins too vague to measure. The wing surface appears to have been hairy, as in the group *Trichosia.*

HOLOTYPE: A.M.N.H. No. 26465, from the Miocene shales at Florissant, Colorado, Station 14.

Requieta, Latin, reposed for a long time.

Sciara sopora, new species

Figure 8

FEMALE: Apparently similar to *Sciara florissantensis* Cockerell, but a much smaller species. Length 3.5 mm.; hind femur 1; hind tibia 1.3. Body somewhat shining, abdomen fuscous, lighter in color than the thorax, first five segments measuring about 1.5 mm., the rest of the abdomen forming a protrusile tube 1.2 mm. long. Wings about 3 mm. long, costa and radius firm and light brown, posterior veins indefinite, R_1 ending 0.8 mm. from the apparent cross vein, lower branch of radius extending 1.65 from same point, the straight-line distance between the ends of the two radial branches 0.9, the anterior branch of radius ending at about 1.7 from base of wing and 1.3 from apex.

HOLOTYPE: A.M.N.H. No. 26466, from the Miocene shales, Florissant, Colorado, Station 4.

Sopora, Latin, sleeping.

CHIRONOMIDAE

KEY TO THE MIOCENE CHIRONOMIDAE FROM FLORISSANT, COLORADO

1. Adults; legs free.......................................2
   Pupae; thorax with lateral wing pads.............................6

2. Body and legs polished black.......... .....*Diamesa extincta*, new species
   Body and legs not or but little polished, lighter in color.................3
3. Male genitalia wider than long, comprising two sturdy, widely encircling claspers..........................*Chironomus scudderiellus* Cockerell
   Male genitalia longer than wide, the claspers relatively narrow and much less curved..4
4. Large, ferruginous species, middle of dorsum castaneous; 7–10 mm...*Chironomus primaevus*, new species
   Smaller, not reddish species...5
5. Thorax brownish, abdomen basally pale, pre-apical segments brownish, legs fuscous............ ....*Chironomus pristinus*, new species
   Thorax and legs piceous, abdomen dark brown, the interstices paler.......................................*Chironomus proterus*, new species
6. Abdomen nearly straight, elongate, more than twice the length of thorax to end of wing, posterior margins of segments each with long, thin, black, chitinous transverse loop...*Chironomus requiescens*, new species
   Abdomen slightly curved down, not over twice the length of thorax to end of wings; segments devoid of long setae or loops..................7
7. Insect entirely dull; head inset under front edge of thorax...*Chironomus pausatus*, new species
   Insect shining; head extending beyond thorax...*Chironomus sepultus*, new species

Diamesa extincta, new species

Figure 4

Length about 4.2 mm.; length of wing 4 mm. Body and legs polished black. Costa, first and third veins very strong and black, auxiliary and second veins simple and weak, basal cells coextensive on media but second basal cell posteriorly extending beyond first because its cross vein is very oblique, other veins indistinct or wanting, third vein ending just before wing tip and 1 mm. beyond end of first vein, costa continuing to end of third vein.

HOLOTYPE: A.M.N.H. No. 26467, from Florissant, Colorado, Miocene shales.

The species greatly resembles the Holarctic *Diamesa waltlii*, but differs in its shining black color. The antennae and end of abdomen are missing, precluding the determination of the sex of the specimen. This is the only one of some three dozen Chironomidae that shows distinct neuration. The stone is peculiar, resembling a flattened oval inclusion, the specimen embedded in a thin, smooth, argillaceous layer.

Two shining blackish specimens from the Lacoe collection of the United States National Museum (U.S.N.M. Nos. 112580, 112582) may be assigned here, although they lack wings and are less perfectly fossilized.

Extincta, Latin, annihilated.

Chironomus primaevus, new species

Figure 15

MALE: Length about 7 mm., the inflexed head 0.6, thorax 1.65, abdomen 5 mm. A dull reddish species, center of mesonotum and lower pleura castaneous, venter and legs somewhat paler, joints of antennae dark. Genitalia slightly longer than wide, oval, measuring 0.4 by 0.55 mm., the forceps gently curved. Wings not discernible.

TYPE MATERIAL: Holotype: A.M.N.H. No. 26469:1, from the Miocene shales, Florissant, Colorado, discovered by William M. Wheeler at Station 13. A topotypic group of three specimens, also found by Wheeler, is represented in obverse and reverse (paratypes A.M.N.H. Nos. 26469:2, 26469:3). Wheeler found another specimen (A.M.N.H. No. 26469:4), slightly larger but less complete, which seems to be the same species.

The assignment of this and the following species to *Chironomus* is intended in a broad sense. Because of the imperfect fossilization of these delicate midges, it is impossible to determine which of the present multitude of genera of the family should include them.

Primaevus, Latin, early in life.

Chironomus pristinus, new species

MALE: Length 5.6 mm.; head and thorax 1.8, abdomen, 3.8. Head, thorax, and legs fuscous, somewhat shining, joints of antennae paler, abdomen light fuscous on basal half, narrow. As preserved, antennae beautifully feathered, wings indefinite, genitalia narrow but the forceps indistinct. The number of antennal joints cannot be stated, and the tibial structure is uncertain.

TYPE MATERIAL: Holotype: A.M.N.H. No. 26470:1, from the Miocene shales, Florissant, Colorado, Station 14; countertype: A.M.N.H. No. 26470:1A; paratopotype: A.M.N.H. No. 26470:2.

Pristinus, Latin, primitive.

Chironomus proterus, new species

Figures 11, 12

MALE: Length 5.5 mm. A beautiful specimen apparently belongs to the restricted genus *Chironomus*. It lacks wings but has well preserved the plumose antennae. The lengthened front legs have the metatarsi nearly equaling the tibiae. Thorax piceous, abdomen dark brown, the interstices paler.

FEMALE: Length 6.3 mm. Thorax and legs piceous, abdomen brown, the interstices paler. Costal half of left wing as in modern *Chironomus*. Front legs as long as entire body.

TYPE MATERIAL: Holotype: Florissant shales, Miocene, British Museum of Natural History, Department of Geology, No. I. 7359. Allotype (female): Same, No. I. 7358.

Proterus, Greek, πρότερος, prior.

Chironomus scudderiellus Cockerell

Several specimens from Stations 12 (A.M.N.H. No. 26472), 13 (A.M.N.H. No. 26472/1), and 14 (A.M.N.H. No. 26472/2) seem to belong to Cockerell's species, though the thorax is only brownish and the legs are pale. The original description states that the thorax is "dark" and the legs are ferruginous. Because these midges were too delicate to undergo complete fossilization no taxonomic advantage would follow their separation from the holotype under another species name.

Four individuals of the species are female and show the pair of terminal flaps of the abdomen, which are triangular with bluntly rounded apex. One of the specimens (A.M.N.H. No. 26472:1), here designated the allotype, has the flaps measuring 0.54 mm. long and 0.3 mm. wide at the base.

Chironomus pausatus, new species

Figure 14

Pupa, in side view. Length, not allowing for the slight curvature, 6.5 mm.; thorax 1.9, by 1.5 deep, thorax to end of wing pad 3, abdomen if straightened 5.45. Dull fuscous, thorax and head somewhat darker than the wing pads and abdomen. Eighth segment of abdomen terminated by a pair of small, nearly triangular flaps, which are slightly incurved, rounded at tip and bear hairs but no teeth. These flaps are 0.45 mm. long and 0.2 wide at base and may be lateral rather than dorsoventral, in case the end of the abdomen is twisted. Wing pads attaining third segment of abdomen, measuring about 2.1 by 0.6 mm. There is no trace of the dorsal respiratory organs.

HOLOTYPE: A.M.N.H. No. 26473, from the Miocene shales, Florissant, Colorado, Station 13.

Although it is possible that the three forms of pupae here described may belong to some of the adults, they have been listed as separate species on the assumption that it is unlikely that adults were flying while their pupae were swimming on the day of extermination.

Pausatus, Latin, resting in the grave.

Chironomus requiescens, new species

Figure 13

PUPA: Length about 9 mm.; head and thorax 2, depth of thorax 1.75, thorax to end of wing pad 3, abdomen 7.2. Head and thorax almost black, with very little trace of sheen, abdomen light fuscous, last two segments a little darker, incisures colorless. First two abdominal segments with several strong black setae on posterior margin, segments three to seven each having the posterior margin delimited by a thin black chitinous loop, which might have resulted from the fusion of a pair of long cruciate setae transversely infolded. The loops seem to be attached near the posterior corners of the tergites and lie free from the integument. As they are more curved than the incisures, they could not have been formed by a thin but strong induration of the hind margins. Last segment of abdomen apparently with a swimming paddle split medianly.

TYPE MATERIAL: Holotype: A.M.N.H. No. 26474:1, from the Miocene shales, Florissant, Colorado, Station 5, collected by William M. Wheeler. Paratype A.M.N.H. No. 26474:2 was found by Wheeler at the same station. Paratypes A.M.N.H. Nos. 26474/1:1 and 26474/1:2, the latter collected by George Rohwer, are from Station 13; paratypes A.M.N.H. Nos. 26474/2:1 and 26474/2:2 (collected by G. Rohwer), from Station 14. Wheeler made a notation that this was the only dipteron discovered at Station 5. Another specimen (A.M.N.H. No. 26476) represents a similar but probably distinct form. It has long abdominal setae but is smaller, with the abdomen relatively shorter. The thorax to end of wing pads measures about 2.7

mm. and the abdomen about 4.3. The specimen exhibits a leaflike structure behind the head, probably the base of the respiratory organ.

Requiescens, Latin, resting in death.

Chironomus sepultus, new species

PUPA: Lateral aspect. Length from tip to tip, not allowing for the curve of the abdomen, 6.3 mm.; head and thorax 1.65, thorax to end of wing pad 2.8, depth of thorax 1.5, abdomen if straightened 5.6. Body entirely shining, head and thorax in general dark fuscous, abdomen pale fuscous, wing pads concolorous with thorax, showing a large pre-apical spot and the costa black, base of legs and middle of notum and scutellum almost black. Eighth segment of abdomen terminated by an anal plate. Wing pads reaching nearly to middle of third abdominal segment, measuring 2.1 by 0.6 mm. Respiratory organs not indicated.

HOLOTYPE: A.M.N.H. No. 26477, from the Miocene shales, Florissant, Colorado.

This fossil is in a dark gray stratum, obviously different from the light gray clay embedding *pausatus*, which species it resembles in its relatively large thorax and curved abdomen.

Sepultus, Latin, destroyed and buried.

SCATOPSIDAE

Reichertella fasciata, new species

Figure 16

FEMALE: Length 3.8 mm. Distinctly pictured on the stone in the usual black color, with no indications of light-colored markings on head, antennae, mouth parts, thorax, and legs. Antennae stout, in length equal to the head. Abdomen showing seven segments, incisures broadly and distinctly marked, the wide abdomen indicating a gravid female. Legs infolded, so the joints not differentiated, all femora stout. Wings hyaline, only the firm blackish anterior veins preserved, first vein ending halfway to the end of the third vein, third vein ending at about seven-eighths the wing length.

HOLOTYPE: U.S.N.M. No. 112563 (R. D. Lacoe collection) from the Miocene shales of Florissant, Colorado.

The species is assigned to *Reichertella*, at present the dominant genus of Scatopsidae, because of the straight course of the long third vein. Its body is too stout for *Psectrosciara*, and the third vein does not turn forward as in *Scatopse*, the other two existing genera with lengthened third vein. The failure of the delicate fourth and other veins to become fossilized makes it impossible to determine the exact generic placement of the fossil.

BIBIONIDAE

KEY TO THE FLORISSANT TERTIARY BIBIONIDAE

1. Third vein branched, second basal cell much shorter than first; legs simple..........2
   Third vein simple, second basal cell much longer than first; front tibiae ending in a strong outer spur..........10
2. Pedicel of second posterior cell about twice the length of anterior cross vein (*Hesperinus*)..........3
   Pedicel of second posterior cell distinctly less than twice the anterior cross vein..........5
3. Wings reddish, longer than abdomen; body more or less reddish..........4
   Wings infuscated, shorter than abdomen; body black.......... *Hesperinus immutabilis*, new species
4. Wings 6 mm., first submarginal cell opposite anterior cross vein of same width as second submarginal at end of second vein; abdomen with narrow pale fasciae.......... *Hesperinus melanderi* Cockerell
   Wings 9 mm., first submarginal cell opposite anterior cross vein nearly twice as wide as second submarginal at end of second vein; pale fasciae of abdomen wider than the dark bands.......... *Hesperinus axelianus* Cockerell
5. Second submarginal cell exceptionally narrow and long, its width at end of second vein about one-third the width of first submarginal opposite anterior cross vein, the fork of third vein at nearly one-third the distance from base of radial sector to wing tip.......... *Penthetria longifurca*, new species
   Second submarginal cell much shorter and broader, its width at end of second vein more than half the width of the first submarginal opposite anterior cross vein, the fork of third vein nearer middle of third vein..........6
6. Length of body 7.7 mm.; wing 6.3 mm., anterior cross vein longer than petiole of fourth vein.......... *Plecia orycta*, new species
   Length over 8 mm.; wing 8 or 9 mm., anterior cross vein shorter than petiole of fourth vein..........7
7. First submarginal cell (R_1) narrow, its greatest width less than 0.4 mm.; abdomen not banded.......... *Plecia explanata* Cockerell
   First submarginal cell broader, its greatest width more than 0.45 mm.; abdominal incisures paler..........8
8. Second submarginal cell narrower, less than 0.4 mm. at end of branch of third vein; abdominal incisures narrow.......... *Plecia decapitata* Cockerell

Second submarginal cell broader, more than 0.4 mm. at end of branch of third vein..9

9. First basal cell longer than second by nearly three times length of anterior cross vein; wings strongly infumated anteriorly..*Plecia tessella*, new species

First basal cell longer than second by about twice length of anterior cross vein; wings uniformly brownish..........*Plecia gradata*, new species

10. No anterior cross vein, the submarginal cell fused a short distance with the second basal; femora not clavate..........*Bibiodes intermedia* James

Anterior cross vein present though reflexed, the submarginal and second basal cells distinctly separated (*Bibio*)..........................11

11. Anterior cross vein more or less in line with outward continuation of third vein and about as long as base of radial sector or longer...........12

Anterior cross vein more or less transverse and about one-fourth as long as base of radial sector......................................16

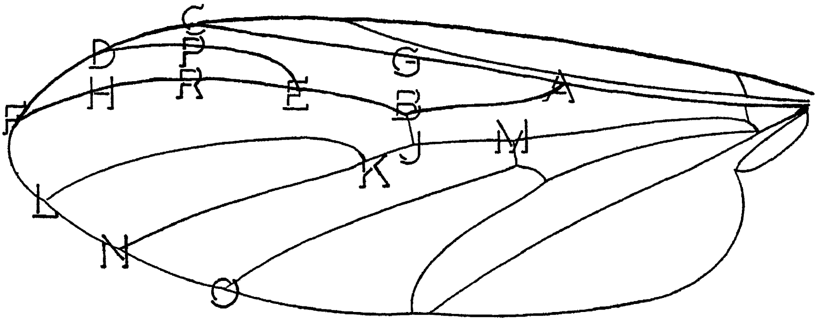


FIG. 1. Generalized neuration of *Plecia* and *Hesperinus*. The lettering indicates points from which measurements are given in table 1.

12. Anterior cross vein much longer than base of radial sector; wings dusky, veins strong; large black species..............*Bibio atavus* Cockerell

Anterior cross vein somewhat shorter than base of radial sector; wings hyaline, posterior veins weak; species under 10 mm..............13

13. Wings strongly fuliginous; body brown, legs paler...*Bibio capnodes*, new species

Wings clear hyaline...14

14. Black species..15

Reddish species; anterior femora short and thick, hind femora strongly clavate at apex, hind tibiae clavate..............*Bibio vetus* James

15. Hind femora strong, at apical third one-fifth as wide as long...*Bibio podager*, new species

Hind femora relatively slender on basal half, at apical fourth about one-seventh as wide as long..................*Bibio jamesi*, new species

16. Abdomen reddish, contrasting with the blackish thorax; species under 10 mm.................................*Bibio cockerelli* James

Abdomen dark brown or black......................................17

17. Abdomen almost unicolorous black or piceous; species under 10 mm.... 18
    Abdominal incisures paler; species over 10 mm. 19
18. Fourth vein arching forward, the second posterior cell at middle wider than the first posterior.................... *Bibio excurvatus*, new species
    Fourth vein nearly straight, the second posterior cell much narrower than the first posterior.................... *Bibio vulcanius*, new species
19. Hind tibiae more slender than femora, only slightly enlarging distally from base, apical width about one-eighth the length.. *Bibio wickhami* Cockerell
    Hind tibiae almost as broad as their femora, apical width about one-fifth the length; neuration weak.............. *Bibio explanatus*, new species

TABLE 1

WING MEASUREMENTS IN MICRONS OF *Plecia* AND *Hesperinus*, BASED ON FIGURE 1

	axelianus	*decapitata*	*explanata*	*gradata*	*immutabilis*	*longifurca*	*melanderi*	*orycta*	*tessella*
A–B	—	1600	1330	—	900	—	—	1000	1760
A–C	—	—	—	—	2550	2850	—	2600	3270
A–E	2880	2560	2400	—	2300	1770	2015	1400	2970
A–L	—	5000	—	—	—	5000	—	—	—
B–G	480	480	368	510	300	420	290	350	600
B–J	272	—	240	480	300	—	—	300	370
C–D	—	720	—	1060	600	900	—	600	1100
C–F	—	2240	—	2735	1500	2100	—	1650	—
C–P	—	—	—	360	220	270	—	360	300
D–F	1760	—	—	1800	1080	1350	1040	1050	—
D–H	480	368	288	450	270	150	160	250	460
E–D	—	—	800	1650	1050	1840	—	1500	1500
E–F	—	—	2320	3170	1950	3060	—	2500	—
M–J	—	—	—	1000	560	—	—	—	1050
M–K	—	—	1200	1740	—	—	—	—	1620
N–O	—	—	1440	—	—	—	—	—	—
P–R	—	—	—	330	180	160	—	180	340
DII:GB	1.00	0.77	0.78	0.88	0.90	0.36	0.55	0 72	0 77
Wing, mm.	9	8	8X2 9	9X3	6X2.46	8X2 5	6X2 3	6 3X2.1	8X3.25

Hesperinus axelianus (Cockerell)

Four specimens in the Lacoe collection of the United States National Museum are probably this species, originally described as a *Plecia*. The wings of all are imperfectly preserved, thus precluding a positive identification. The specimens are slender, with brownish thorax and legs, the abdomen is mostly yellowish, with the anterior third or so of each segment brownish.

Hesperinus immutabilis, new species

Figure 17

Length 9 mm. Entirely piceous; tibial spurs not apparent; second basal cell complete, truncately closed, and 560 μ shorter than first basal, anterior branch of third vein slightly longer than half of posterior branch. Wing 6 mm. long by 2.46 mm. wide, lightly infumated, darker in front, anterior veins strong and dark, third vein apically curving to end at wing tip, entire length of second vein 4.2 mm., second submarginal cell narrow, above 1.05 mm., below 1.95 mm., apically 1.08 mm., width at middle 0.27, media uniformly firm from root of wing, 3 mm. to fork, length of second posterior cell 2.525 mm., first cubitus sharply angulate at apex of second basal cell where it forms a continuous line with the posterior cross vein and then sharply bends to continue midway between the media and the second cubitus.

TYPE MATERIAL: Holotype: U.S.N.M. No. 112554 (Lacoe collection) from the Miocene shales, Florissant, Colorado. Another specimen, U.S.N.M. No. 112588, somewhat smaller, appears to belong here; this paratype is illustrated in figure 17. The species is almost exactly like the existing *Hesperinus brevifrons* Walker.

Immutabilis, Latin, unchangeable.

Hesperinus melanderi (Cockerell)

A male measuring 9 mm. but with small wings about 6 mm. long appears to be the same as Cockerell's species, described as a *Plecia.* It compares well with the photographic illustration of the type, but because of its vague neuration its identity cannot be positively assured. R. D. Lacoe collection, U.S.N.M (study number 246).

Penthetria longifurca, new species

Figure 18

FEMALE: Length 9.25 mm. Wholly reddish, the head and pleura darker, legs, abdomen, and wings concolorous, anterior veins fuscous, posterior veins weak and incompletely indicated. Distinct from all the other species in the formation of the second submarginal cell, which is very long and narrow, the branch of the third vein arising in an abrupt curve and then continuing for two-thirds its length midway between the second and third veins to the end of the second vein and then slightly diverging from the third vein as the latter curves towards the wing tip. Neuration measurements given in the table. Hind legs uniformly slender, the femora and tibiae each 3 mm. long.

Holotype: U.S.N.M. No. 112551, R. D. Lacoe collection.

Plecia gradata, new species

Figure 19

Female: Length 11.5 mm. Head, thorax, and legs black, abdomen dark brown, the hind margins of the segments narrowly pale, giving the abdomen a scalariform appearance. Wings ruddy brown, the costal area not appreciably darker, veins firm and brown. Neuration measurements given in table. Hind femora not pedunculate, 3 mm. long, clothed with fine short recumbent black hairs.

Holotype: A.M.N.H. No. 26481, from the Miocene shales of Florissant, Colorado, Station 13; collected by William M. Wheeler in 1906.

Plecia orycta, new species

Figure 21

Length 7.7 mm.; head 0.75, thorax 1.95, abdomen 5.1; wing 6.3 by 1.8 mm. Dorsal view of a fine, wholly black species, with infumated wings, the stigmal area stronger. Neurational measurements as given in the table. Legs slender, front tibiae measuring 2 mm., hind tibiae 2.3 mm.

Holotype: U.S.N.M. No. 112569 (R. D. Lacoe collection), from the Miocene shales, Florissant, Colorado.

Orycta, Greek ὀρυκτή, dug out of the earth.

Plecia tessella, new species

Figure 20

Female: Length 11 mm. Head and thorax black, legs dark brown, abdomen fuscous, the posterior third of each segment pale; wings gradually paler from the infumated costa, the hind margin nearly colorless, anterior veins firm and brown, posterior veins paler though distinct. Neuration as indicated in table 1. Hind femora and tibiae each 3 mm. long, clothed with fine, short, appressed black hairs.

HOLOTYPE: U.S.N.M. No. 112562 (R. D. Lacoe collection), from the Florissant shales, Miocene.

Tessella, Latin, a small square piece of stone.

Bibio capnodes, new species

Figure 30

FEMALE: Length of headless body 9 mm. Body light brown, abdominal incisures indicated by a slightly darker line; legs probably rufous in life. Abdomen very robust, indicating a gravid female. Abdomen and legs furnished with short scattered dark hairs. Anterior legs missing; hind femora gradually somewhat clavate, measuring 3.6 mm., greatest width at distal fourth 0.6 mm., width at base 0.33 mm.; hind tibiae 3 mm. long, width at the nearly truncate apex 0.45 mm., width near base 0.2 mm.; hind metatarsi 1.35 mm. long and 0.2 mm. wide. Wings broad, 8 mm. long by 3 mm. wide at middle, anterior third of wing membrane strongly reddish brown, the anterior veins concolorous and scarcely differentiated, posterior two-thirds of wing similarly though less intensely brown, the veins fuscous and quite distinct, length of basal section of radial sector 0.9 mm., anterior cross vein 0.47 mm. long and strongly reflexed, second posterior cell acute at base.

HOLOTYPE: U.S.N.M. No. 112565 (R. D. Lacoe collection) from the Miocene shales at Florissant, Colorado.

Capnodes, Greek καπνωδης, as if burnt to ashes.

Bibio cockerelli James

Figures 23, 24

Twenty-one specimens of this moderate-sized species show the blackish thorax and reddish abdomen. Three of these fossils (A.M.N.H. No. 26484) were found at Station 4, three (A.M.N.H. No. 26484/1) at Station 11, and three (A.M.N.H. No. 26484/2) at Station 14. The others are from several accessions of the R. D. Lacoe collection at the United States National Museum, indicating an extended distribution in time for this species.

James described the hind tibiae as clavate with the greatest enlargement apical. The specimens assigned to this species have the hind tibiae rather slender in profile and only slightly but gradually enlarging apically. One specimen, from Station 4, was fossilized so as to show the extensor aspect of the hind leg. Its tibia appears more clavate, widest before the distal third. This specimen is remarkable in that the wings and abdomen are white in both halves of the stone. A comparison with the holotype of *cockerelli* may show that the new material is different, as suggested by the structure of the hind legs. The anterior cross vein is variable in length, sometimes represented by a knotlike fusion between the third and fourth veins.

Bibio excurvatus, new species

Figure 27

MALE: Length 7.75 mm. A dark species distinguished by having the fourth vein strongly arching so that the second posterior cell at its middle is somewhat broader than the first posterior cell. Head and thorax black, abdomen piceous, the incisures narrowly slightly paler, genitalia stout and black. Wings smoky, especially in front, posterior veins weak though recognizable, stigma not prominent.

HOLOTYPE: U.S.N.M. No. 112550 (Lacoe collection) from the Miocene shales, Florissant, Colorado.

Excurvatus, Latin, bending out, i.e., the fourth vein.

Bibio explanatus, new species

Figure 28

FEMALE: Length 11.5 mm. Body and legs black, the abdominal incisures narrowly paler; pubescence not indicated. Front femora short and robust; middle femora fusiform, 1.5 mm. long and 0.45 mm. wide at middle; middle tibiae 1.56 mm. long, uniformly and slightly enlarging, the apex 0.3 mm. wide, the base 0.21 mm.; middle tarsi slender, 2.4 mm. long, the basal joint 1.275 mm. in length; hind femora 3.5 mm. long, definitely clavate, widest 0.9 mm. from the end at which place it measures 0.75 mm.; hind tibiae uniformly expanding almost to the apex, 2.94 mm. long and 0.6 mm. at the pre-apical width; hind tarsi tapering, 2.71 mm. long, the metatarsus 0.975 mm. long and 0.3 mm. wide, the second joint 0.6 mm. long and 0.27 mm. wide. Wings hyaline, anterior veins brownish, posterior veins not distinguishable, neuration difficult to decipher, but the submarginal cell appears almost to touch the discobasal cell at the location of the extremely short anterior cross vein.

HOLOTYPE: A.M.N.H. No. 26485 from the Florissant Miocene shales, Station 11. Both halves of the fossil are represented; the reverse is A.M.N.H. No. 26485A.

Explanatus, Latin, flattened out.

Bibio jamesi, new species

Figure 26

MALE: Length 7 mm. Wholly black, the abdominal incisures at most very faintly and narrowly indicated. Upper facets large. Front femora robustly fusiform, greatest width at middle third of their length; hind femora very slender on basal half then clavately swelling but decreasing just before tip, in length 2.55 mm., greatest width 0.45 mm.; hind tibiae 2.4 mm. in length, 0.45 mm. wide at distal fourth, strongly rounding at apex; hind metatarsi 1 mm. long and 0.24 mm. wide. Wings hyaline, anterior veins and stigma very faint, posterior veins indistinguishable.

TYPE MATERIAL: Holotype: A.M.N.H. No. 26486, from the Miocene shales at Florissant, Colorado, Station 4. A.M.N.H. No. 26486A has been assigned to the reverse of the holotype. Two paratypes, U.S.N.M. Nos. 112576 and 112579, have the abdominal incisures concolorous black.

If the interpretation of the anterior cross vein is incorrect, this species would key to *vulcanius*, from which it differs by its weak neuration, the slender basal half of the hind femora, and the rounding apex of the hind tibiae.

The species is named in recognition of the studies on Florissant Miocene Diptera by Prof. Maurice T. James, as well as for his keen discrimination of existing Diptera.

Bibio podager, new species

Figure 25

MALE: Length 8 mm. Body and legs wholly black, abdominal incisures not paler, pubescence not visible. Head missing. All femora very thick, the front ones measuring 2.1 mm. long and 0.72 mm. wide at middle, the hind femora fusiform, 2.7 mm. long and 0.6 mm. wide at distal third; tibiae imperfect but apparently very stout. Wings nearly hyaline, anterior veins and stigma thin and brown, posterior veins indistinguishable, anterior cross vein in direct line with the third vein, measuring 0.3

mm., the base of the radial sector 0.5 mm., last section of third vein 3 mm.

Holotype: A.M.N.H. No. 26487 from the Miocene shales at Florissant, Colorado, Station 4. An imperfect female, A.M.N.H. No. 26487/1, measuring 7.5 mm., is apparently the same species.

A female in the National Museum collection, study number 236, has all the femora heavily incrassate, but the abdomen is dark brown instead of carbonized black like the others.

Podager, Greek ποδαγρός, having swollen legs.

Bibio vetus James

One specimen of the Lacoe collection of the National Museum, study number 232, and another, from Station 14, in the American Museum (A.M.N.H. No. 26488) measure 9 mm. and are apparently an all-reddish *Bibio* with strongly clavate hind femora. Because the venation is poorly preserved it cannot be positively stated that they belong to *vetus*, which is characterized by having a relatively long anterior cross vein. Another specimen from the National Museum, number 233, belonging in the first lot, shows the neuration of *vetus*, but the thorax is darker than in the holotype. The hind tibiae are as stout as the femora.

Bibio vulcanius, new species

Figure 29

Male: Length 9 mm. Apparently a wholly black species, although where the carbonization has worn off part of the mesonotum the ground color is shining fuscous. This is not the case on the abraded spots of the legs and abdomen, which are concolorous with the adjacent shale. The part of the fossil bearing the head was destroyed when the stone was first split, and the anterior legs are not preserved. No pubescence is indicated. The incisures of the abdomen are not paler. Hind femora relatively slender, gradually widening on the proximal three-fourths, where the diameter is one-fifth the length. Hind tibiae uniformly widening almost to the truncate tip where the greatest breadth is nearly one-fourth the length. Hind tarsi robust, the metatarsus one-half longer than the second joint. Wings hyaline, anterior veins and stigma very firm and black, posterior veins very weak, second posterior cell sessile, the contact with the discobasal cell equal to the almost transverse anterior cross vein. The following measurements are in millimeters: length of anterior cross vein 0.15, length of stem of third vein before anterior cross vein 0.51, length of last section of third vein 3, length and greatest width of hind femur 3:0.6, length and greatest width of hind tibia 1.05: 0.3.

TYPE MATERIAL: Holotype: U.S.N.M. No. 112564 (Lacoe collection), from the Miocene shales, Florissant, Colorado. A second specimen in obverse and reverse from the same lot (U.S.N.M. No. 112572), measuring about 8 mm., appears to belong here, though obviously from a different stratum. A third specimen (A.M.N.H. No. 26489) represented on both halves of the fossil, from Station 11, is almost certainly the same species as the holotype.

Vulcanius, belonging to Vulcan, the god of volcanic fire.

Bibio wickhami Cockerell

Figure 22

This large species was common in the Miocene at Florissant. The American Museum collection contains 10 specimens from Stations 4, 11, 13, and 14 (A.M.N.H. Nos. 26490, 26490/1, 26490/2, and 26490/3, respectively). The United States National Museum has three lots from Lacoe, comprising 12 specimens. Most of the specimens are on a roughened shale and the venation is not distinct. Some have a darkened abdomen, not contrasting with the thorax; in others the abdomen is brownish. The small inner spur of the front tibia, the short anterior cross vein, and the large size characterize this species.

STRATIOMYIIDAE

MOYAMYIA, NEW GENUS

An incomplete specimen of an enigmatical fly was discovered by William M. Wheeler at Station 14. The bit of shale shows it surrounded by a dozen Chironomidae and Psocidae. Although some taxonomic structures are vague or lacking, enough of the insect is preserved to indicate that the fly is clearly a stratiomyiid, probably in the Clitellariinae, but unlike any genus hitherto recorded. The prominent stigma is entirely distal to the discal cell, and the stout anterior branch of the third vein perpendicularly enters the stigma near its middle. Other Stratiomyiidae have the stigma in front of the discal cell, and the branch of the third vein, when present, is located beyond the stigma.

Abdomen with six segments; scutellum unarmed; discal cell small and short, seven- or possibly six-sided, third vein heavy, its anterior branch very thick, erect, and extending to the stigma at basal two-fifths, posterior veins evanescent.

GENOTYPE: The following species.

Moyamyia limigena, new species

MALE: Length 5 mm.; head about 0.6, thorax 0.2, abdomen 2.4; wing 3. Head and thorax black, abdomen and legs dark castaneous, wings hyaline, veins pale. Discal cell 0.3 by 0.3 mm., anterior cross vein about 0.075 in length, stigma 0.75 long by 0.15 deep near middle, third vein 0.6 between anterior cross vein and fork and 1.2 beyond fork, anterior branch of third vein 0.18 long.

HOLOTYPE: A.M.N.H. No. 26494 from the Florissant Miocene shales, Station 14. Most of the anterior part of the head, including the antennae, is missing, but it seems that the lower face is not protruding. No pile is visible on the eyes or body. The imprint of the insect on the stone is too weak for adequate photographic reproduction.

Moyamyia, moya, South American, volcanic mud, plus *myia,* Greek, fly. *Limigena,* Latin, produced in pond ooze.

RHAGIONIDAE

KEY TO THE FLORISSANT MIOCENE SPECIES

1. Nearly 20 mm., reddish species with small head, abdomen with paler basal bands.................................*Dialysis revelata* Cockerell
   Ten mm. or less..2
2. Anal cell closed before margin of wing..................................3
   Anal cell open on margin..................................5
3. Fourth posterior cell closed..................................4
   Fourth posterior cell open..................*Atrichops hesperius* Cockerell
4. Anterior cross vein near base of discal cell........*Solva moratula* Cockerell
   Anterior cross vein at basal two-fifths of discal cell.......................................*Solva inornata,* new species
5. Abdomen not fasciate..................*Symphoromyia subtrita* Cockerell
   Abdominal segments bicolored..................................6
6. Abdomen more blackish than yellow; first basal cell not longer than second..................................7
   Abdomen more yellowish than black; first basal cell somewhat longer than second, fork of third vein before end of discal cell.................................*Rhagio wheeleri,* new species

7. Marginal cell widest at middle and strongly clouded; 9 mm. . . . . *Rhagio mystaceaeformis* Cockerell
Marginal cell widest beyond middle, scarcely darkened; 7 mm. . . . . *Rhagio fossitius*, new species

Dialysis revelata Cockerell

Figure 34

A specimen of this fine species (A.M.N.H. No. 26495) was discovered by Wheeler at Station 14. Both sides of the stone are pictured, but the neuration is only indistinctly and incompletely preserved. Mouth parts, antennae, and tibial spines are not indicated, but the general habitus is so like modern *Dialysis* that the specimen can well be considered as the same species described by Cockerell in 1908. The small head is distinctive.

Solva (Xylomyia) inornata, new species

Figure 33

FEMALE: Length 9.5 mm. Body wholly black, legs apparently yellow except the darkened hind tarsi; abdomen elongate, slender and tapering beyond the fourth segment. Head 1.2 mm. long, thorax 2.1, abdomen 6.2. Annulations of third antennal joint distinct. Wings 6.75 mm. long, nearly hyaline, unmarked, veins firm and dark, second vein ending in line with forking of third vein and apex of discal cell. The following measurements in microns, on straight line between terminal points without allowance for curves: length of second vein 1800, prefurca 1000, anterior cross vein to fork of third vein 1000, anterior branch of third vein 1450, lower side of second submarginal cell 2100, first submarginal cell on costa 1450, second submarginal on costa 1100, discal cell on first basal 600, under side of discal cell 1200, second posterior cell on first posterior 1900, on third posterior 1525, third posterior cell on fourth posterior 1350.

HOLOTYPE: U.S.N.M. No. 112568 (R. D. Lacoe collection), from the Miocene shales, Florissant, Colorado.

Cockerell has described *Xylomyia moratula* from Florissant. The neuration of his species is much like that of the European *X. maculata*, Verrall's figure. The present species conforms more closely to the European *X. marginata*, not only in venation but also in the more somber body coloration. The legs are not well enough preserved to indicate the structure of the femora.

Rhagio fossitius, new species

Figure 31

Length 7 mm. Head and thorax black, abdomen mostly blackish, sides of basal tergites and posterior third or fourth of the others yellow; body loosely covered with short black hairs; legs pale yellow, the hind tibiae apically and the hind tarsi darkened; wings uniformly but lightly infumated, no stigma, veins brown, the anterior veins well marked though narrow, the posterior veins very delicate. Wings 5 mm. long by 1.95 wide at middle. The following measurements in microns, auxiliary vein ending at 2600, first vein ending 900 farther, second vein ending 450 beyond first vein, anterior branch of third vein arising at angle of 60 degrees and ending just before wing tip, the second submarginal cell 450 at apex and 1450 from end of second vein, prefurca 500, ratio of the three sections of third vein 540: 1300:1860, discal cell 1800 long by 450 wide, greatest width of anal cell just beyond middle 540.

Holotype: U.S.N.M. No. 112626 (R. D. Lacoe collection), from the Miocene shales at Florissant, Colorado.

Fossitius, Latin, dug out of the ground.

Rhagio wheeleri, new species

Figure 32

Female: Length 9 mm., wing 8 by 2.5 mm. Head black, center of mesonotum and metathorax dark, humeri, sides, pleura, and scutellum yellowish; abdominal segments light colored but each marked with a basal brownish spot becoming transverse on fourth and remaining segments; legs pale, the tarsi brown; wings hyaline, veins light brown, marginal cell widest opposite end of auxiliary vein, branch of third vein ending at apex of wing, 1700 μ from end of second vein, the branch 2400 μ long and arising at an angle of 75 degrees, second submarginal cell 650 μ wide at apex, prefurca 750 μ, the sections of third vein 700:1150: 2400, disca. cell 2100 μ long by 600 wide at end, the upper side as divided by the cross vein 550:1425, intercalary vein 1260 μ, last section of fifth vein 990 μ.

Type Material: Holotype: A.M.N.H. No. 26496:1; graphotype A.M.N.H. No. 26496:2; paratypes A.M.N.H. Nos. 26496: 3, 26496:4, 26496:4A; all from the Miocene shales, Florissant, Colorado, collected by William M. Wheeler at Station 14. A less perfect specimen in the R. D. Lacoe collection (U.S.N.M. No. 112574) appears to be the same, though obviously from a different stratum. The species is very much like the modern *Rhagio vertebratus* Say, but that species has the fork of the third vein beyond the end of the discal cell. *Rhagio wheeleri* is named in commemoration of its discoverer, as a slight token of my profound regard for the late dean of entomologists.

NEMESTRINIDAE

There are in the assemblage of Florissant Diptera three specimens of the large and beautiful Nemestrinidae. One from the Lacoe collection is too imperfect for determination. Another, belonging to the British Museum, belongs to *Neorhynchocephalus melanderi* (Cockerell) and is the fifth specimen of this species to be discovered. Part of the head and the apex of the abdomen are lacking, but one wing is complete and shows the neuration to conform with that of *N. melanderi* as given by Bequaert and Carpenter (1936, Jour. Palaeont., vol. 10, p. 400). No pubescence is visible on the body. (Br.M.N.H. No. I.7383.)

The third specimen (A.M.N.H. No. 26497) is a well-preserved female of *Neorhynchocephalus occultator* (Cockerell), in dorsal view, with the wings outspread, and illustrated as figure 35. It shows the fine pubescent vestiture. The neuration is weak, but by tilting the stone under the microscope the course of the veins can be traced, exactly like the figure of *occultator* as given by Bequaert and Carpenter.

THEREVIDAE

Nebritus willistoni, new species

Figure 36

FEMALE: Length about 6.5 mm.; head 0.9, thorax 2.6, abdomen about 3; wing 4.8. Apparently a reddish insect with testaceous legs and fuliginous wings. Vertex and front flat, nearly horizontal, projecting above and between the antennae, face prominent, cheeks not bulbous; eyes small; antennae porrect, first joint coarctate, 0.42 mm. long and about 0.17 wide at middle, second joint short, third joint but slightly tapering, about 0.54 mm. by 0.12; palpi horizontal, spatulate, provided with hairs. Abdomen furnished with fine pubescence, visible in part. Legs slender. Both wings seem to be distorted and lack the cross veins and parts of the longitudinal veins, so that distinctive features of the neuration cannot be ascertained. The second submarginal cell seems to be narrow, and the third and fourth veins seem to join apically, as in the Old World genus *Xestomyia.*

HOLOTYPE: U.S.N.M. No. 112553 (R. D. Lacoe collection) from the Miocene shales, Florissant, Colorado.

This species seems to come sufficiently close to the modern Californian *Nebritus pellucidus* Coquillett to be included with it in the same genus. In *pellucidus* the antennae emerge from anterior frontal swellings, while the first antennal joint is longer than the third, is concave above and is set with bristles. The fossil has the long flattened front and greatly swollen basal joint of the antennae, which are the main taxonomic characters setting off *Nebritus.* It also has a pre-apical spot on the third antennal joint, which suggests the peculiar setigerous pit of *Nebritus. Tabuda planiceps* also has a horizontal front but has a narrow first antennal joint and the third joint is shortened.

Cockerell has described three fossil Therevidae from Florissant, all of which are entirely different from the present form.

I have selected the species name in appreciative memory of my early mentor, Samuel Wendell Williston, who first acquainted me with the Florissant Diptera and whose instructive suggestions about insect phylogeny have been a continual inspiration in my taxonomic studies.

BOMBYLIIDAE

TABLE OF THE SPECIES OF *Alepidophora* COCKERELL

1. Branch of third vein nearly paralleling the bulbous end of marginal cell... .... *pealei* Cockerell

   Branch of third vein diverging from the recurved end of the second vein, so that the costal distance between them is much greater than the diameter of the first submarginal cell at the bulb.................. 2

2. Third posterior cell scarcely narrowed apically, almost as wide on the wing margin as the second posterior cell................ *minor,* new species

   Third posterior cell noticeably narrowed apically, about half as wide on the margin as the second posterior cell............. *cockerelli,* new species

Alepidophora minor, new species

Figure 39

FEMALE: Length 6.75 mm.; wing, 6.35 by 2.2; head and thorax, 2.94; abdomen, 3.81 by 1.95 mm. Head and thorax black, abdomen dark brown, with wide colorless membranous spaces between the sclerites, possibly because of its gravid condition; coxae and legs light fuscous; wings hyaline, veins brown, neuration essentially as described by Cockerell for the genotype.

HOLOTYPE: A.M.N.H. No. 26498, from the Miocene shales at Florissant, Colorado, Station 13.

The species is very much like *A. pealei* Cockerell, described in 1909, but its body is only about half the size, while the wings are nearly as long as in that species. The patches of hairs of the abdomen are not visible.

Alepidophora cockerelli, new species

Figure 40

MALE: Length 9.25 mm.; wing almost 6 by 1.8; head and thorax to end of scutellum 3.375; abdomen 6.6 by 2.55 mm. Head and thorax black, abdomen fuscous, with wide, colorless, transverse spaces between the sclerites, genitalia globular and blackish. Sides of thorax above root of wing and scutellum with several black bristles, posterior margin of tergites with a row of black setulae. Legs blackish. Wings hyaline, veins light brown, third and fourth veins divergent at anterior cross vein to end of discal cell, then converging. The following wing measurements are in microns: prefurca 250, anterior cross vein 180, third vein from prefurca to anterior cross vein 1700, discal cell on first basal 1450, on second basal 300, on first posterior 500, on second posterior 240, on third posterior 750, the cross vein proximally arched and then straight and parallel with hind margin, discal cell on fourth posterior 800, length of second basal cell 1350, second basal on fourth posterior 150, third posterior on second posterior 600, on fourth posterior 790, on margin 300, marginal width of first posterior cell 125, of second posterior 750, of anal cell 125, width of anal cell at middle 300.

HOLOTYPE AND COUNTERTYPE: A.M.N.H. Nos. 26499, 26499A, from the Miocene shales, Florissant, Colorado, at Station 14.

I am happy to dedicate this fine insect in memory of the late Theodore Dru Alison Cockerell, the versatile proponent of the Florissant Tertiary insects.

Amphicosmus delicatulus, new species

Figure 37

MALE: Three submarginal cells present, second vein greatly reflexed at end, the marginal cell apically bulbous, four posterior cells all open, anal cell open; abdomen slender. Head and thorax 2 mm., abdomen 2.85; wings 3.3 by 1 mm. Head and thorax fuscous, abdomen yellow, the globular genitalia brownish, hind femora fuscous, the tibiae paler; wings clear hyaline, veins brownish, no stigma, posterior veins very weak, first vein fusing with costa along middle third of wing, width of bulbous end of marginal cell 240 μ, the inner corner at end of second vein 100 degrees, length of second submarginal cell along third vein 900 μ, the branch vein sinuous, prefurca 200 μ, third vein between prefurca and fork 1350, length of first basal cell 1650, of second basal cell 800, discal cell on first basal 660, on first posterior 400, discal on third posterior 500, the bounding vein proximally arched, greatest width at middle of anal cell 150, width at apex 60.

HOLOTYPE AND COUNTERTYPE: A.M.N.H. Nos. 26600, 26600A, from the Miocene shales at Station 11, Florissant, Colorado, S. A. Rohwer, collector.

Although the cross vein leading from the second submarginal to the bulbous end of the marginal cell is but vaguely indicated, I believe it was normally present. If I am mistaken in detecting this cross vein the species is to be located near *Paracosmus*. The venation corresponds with *Amphicosmus cincturus*, as figured by Williston and by Curran, but the extreme base of the second submarginal cell is narrower.

Protophthiria atra, new species

Figure 38

FEMALE: Length 7.5 mm. Body uniformly blackish; vestiture, if any, not preserved; wings hyaline. Face short; basal joint of antennae stout, cylindrical, square in profile, hairy above, the second joint small, the third joint 2.5 times as long as deep, widest just before middle, then uniformly tapering to the blunt apex, proboscis apparently inflexed and more than twice the head height Wings immaculate, no stigma, veins thin but firm, blackish, first basal cell longer than second by nearly length of anterior cross vein, contact of second basal with discal cell 460 μ, with fourth posterior cell 450 μ, pedicel of third vein equaling last section, the anterior branch widely arching at base, anterior cross vein nearly perpendicular and located 600 μ from base of discal cell and 1200 from apex, on third vein the anterior cross vein is 910 μ from junction of second vein and 1840 from submarginal fork; first posterior cell widely open, width of second posterior cell at base equal to anterior cross vein; vein between discal and third posterior cell parallel with margin, sides of third posterior cell not converging; anal cell closed before margin, but short-petiolate.

HOLOTYPE: U.S.N.M. No. 112552 (Lacoe collection), from the Miocene shales, Florissant, Colorado.

The species is larger than most phthirias and differs in having the anterior cross vein placed much before the middle of the discal cell and in having a relatively short second submarginal cell. Present-day phthirias have the anterior cross vein located at or beyond the middle of the discal cell, and the furcation of the third vein is opposite the posterior cross vein. The fossil differs from *Protophthiria palpalis* Cockerell, also from Florissant, in its shorter abdomen, longer proboscis (if the interpretation is correct that the pendant structure under the head is the proboscis and not part of the front leg), enlarged basal joint of the antennae, proximal placement of the anterior cross vein, and distinctly larger second basal cell. The species is more robust than *Lithocosmus*, with which it agrees in the proximal location of the anterior cross vein, but that genus is excluded from the Phthiriinae by having a distinct spiniform process terminating the antennae.

Apolysis magister Melander

Figure 42

Apolysis magister MELANDER, 1947 (Sept.–Dec. 1946), Psyche, vol. 53, p. 47, pl. 2, fig. 3.

A beautiful specimen from Florissant, U.S.N.M. No. 112573 (Lacoe collection), is the fossil designated as paratype in the original description. The posterior veins are not definitely indicated, but the discal cell appears to be open as in *Apolysis*. The proboscis extends straight forward and, when uncovered after the photograph was made, projects more than twice the head height. The antennae are blunt, and the third joint is almost cylindrical, slightly widened just beyond the middle. The branch of the third vein ends just before the tip of the wing; the last two sections of the third vein are equal.

Melanderella testea, new species

Figure 41

Length 9.5 mm. Black; abdomen narrow and parallel sided, more than twice as long as head and thorax together, measuring 6.75 mm., the segments narrowly fasciate on the hind margins, the pale bands occupying about one-sixth the segments, posterior lateral corners of the basal three segments not well chitinized so the fossil appears to have the anterior angles lobate, as in the species of *Pachysystropus.* Legs mostly pale, hind knees and tibiae fuscous, hind femora incrassate and finely pubescent, hind tibiae infolded against the femora. Wings long and narrow, without alula, measuring 4950 μ long by 1200 wide, nearly hyaline, veins fuscous, length of auxiliary vein 1800 μ, of first vein 2550, prefurca short, 150 μ, second vein beyond prefurca 3000, upper branch of third vein 1350, not elbowed nor appendiculate, width of second submarginal cell on marginal 500, third vein gently curving away from second to end well beyond wing tip, end of fourth vein not preserved, width of first basal cell at base of discal cell 140, anterior cross vein 700 from base of discal cell, length of second basal cell 1300, apical width of second basal 240, anal cell on third posterior cell 560. Knob of halteres black, unexpectedly well preserved, chitinized as in the Systropodinae.

HOLOTYPE: U.S.N.M. No. 112553 (R. D. Lacoe collection), from the Miocene shales, Florissant, Colorado.

Testea, Latin, made of baked earth.

The legs of modern Bombyliidae are slender, adapted for alighting and not for walking. Two of the Florissant genera of Systropodinae have the hind femora incrassate. In *Pachysystropus* the first posterior cell is closed; in *Melanderella* this cell is open. Unfortunately the present specimen does not show the condition of the apex of the fourth vein, but because of the slight curvature of the anterior branch of the third vein the species has been placed in *Melanderella. Pachysystropus condemnatus* has the branch of the third vein strongly sinuous; *P. rohweri* has it elbowed and appendiculate.

TABLE OF THE SPECIES OF *Melanderella* COCKERELL

Wings longer than abdomen; abdomen less than twice as long as head and thorax together.................................... *glossalis* Cockerell

Wings shorter than abdomen; abdomen more than twice as long as head and thorax together.................................... *testea,* new species

ASILIDAE

Senoprosopis eureka, new species

Figure 43

Wing 13 by 3 mm., brownish yellow, long and slender, narrowed at tip, anal lobe small, alula reduced. Marginal cell closed and short-petiolate, two submarginal cells, five posterior cells, second submarginal cell one-third longer than its pedicel, fourth posterior and anal cells closed and short-petiolate, second basal and fourth posterior cells in contact in a point, discal cell very narrow, the under side scarcely angulate at junction of M_3, anterior cross vein beyond middle of discal cell, auxiliary vein entering costa at middle of wing, second vein forking just before base of discal cell, the prefurca long, M_3 arising midway between the cross veins, curving, but in general parallel with the posterior cross vein. The following measurements are in millimeters: petiole of marginal cell 0.57, of second submarginal cell 2, radial sector 1.65, upper branch of third vein 3.75, sections of upper side of discal cell 2.25:1.2, of lower side 2.5:0.66, upper side of second posterior cell 3, of lower side 1.65, third posterior cell on wing margin 2.4, fourth posterior cell on wing margin 1.35.

HOLOTYPE AND REVERSE: A.M.N.H. Nos. 26602, 26602A, from the Miocene shales at Florissant, Colorado, Station 14.

Eureka, Greek, εὕρηκα, I have made an unexpected discovery!

This fly, represented by one wing attached to a bit of the body, is difficult of exact placement. The lack of head and legs prevents comparison with the majority of genera, but by a process of elimination the insect finds proper location in the Asilidae. The slender wing, with reduced anal field and small alula, a narrow discal cell, closed marginal, fourth posterior and anal cells, narrow second submarginal cell with the anterior branch of the third vein ending at the wing tip, and especially the absence of the small cross vein between the second basal and fourth posterior cells place the insect in the subfamily Asilinae.

The genera of Asilinae are differentiated largely on other characters than venation, therefore the positive generic location of the fossil must await the discovery of a more complete specimen. The wing agrees well enough with modern species of *Senoprosopis* to admit placement in that genus. The second submarginal cell is not lyriform as in *S. arizonensis* Williston, and the fourth posterior cell is closed farther from the margin than in the New Zealand *S. meridionalis* Hutton, the two species I have for comparison, but these are not generic distinctions.

James has recently described *Senoprosopis antiquus*, also from Florissant, in which the second submarginal cell is more than twice as long as its petiole.

Senoprosopis was established by Macquart in 1838 for an Indian species. Since then it has been found to have a wide distribution, as two species have been reported from New Zealand, four from Brazil, and one from Arizona. Macquart selected his generic name in reference to the very narrow face. Williston, 1893, corrected the orthography to *Stenoprosopus*, and this spelling was accepted by Aldrich in his "Catalogue." In Kertesz' "Catalogus" the name is given as *Stenoprosopis*. That the original spelling was not a typographical mistake is evident from Macquart's use of Senoprosope or *Senoprosopis* five times in the "Diptères exotiques," as well as erecting the genera *Senobasis*, *Senogaster*, *Senometopia*, *Senopterina*, *Senotainia*, and *Senoxericera*. *Seno-* evidently was Macquart's predilection for στενο-.

EMPIDIDAE

Key to the Miocene Empididae of Florissant

1. Third vein forked...2
Third vein simple...7
2. Abdomen much longer than basal width; proboscis longer than head....3
Abdomen short and broad; proboscis shorter than head; intercalary vein abbreviated..............................*Progloma rohweri* James
3. Proboscis porrect; discal section of fifth vein very short...*Acallomyia probolaea*, new species
Proboscis inflexed (*Empis*)...4
4. Length over 7 mm...5
Less than 6 mm. in length...6
5. Branch of third vein ending close to end of second vein.....................................*Empis perdita* Cockerell
Branch of third vein ending about midway between ends of second and third veins.............................*Empis infossa*, new species
6. Last section of third vein subequal to branch; robust, 5.5 mm. long, hind femora stout.........................*Empis miocenica* Cockerell
Last section of third vein about two times length of branch; less robust, 4.5 mm. long.......................*Empis florissantana* Cockerell
7. Discal and second basal cells separated, four posterior cells (*Rhamphomyia*)..8
Discal and second basal cells united, three posterior cells; front femora thickened........................*Tachypeza primitiva*, new species

8. Prefurca short and strongly curved, anterior cross vein beyond basal third of discal cell and not exceeding 176 μ in length..................9
Prefurca longer and gently curved..................................10
9. Apical distance between second and third veins more than twice that between third and fourth veins.....*Rhamphomyia hypolitha* Cockerell
Apical distance between second and third veins less than twice that between third and fourth veins; abdomen with many coarse hairs.......... ....*Rhamphomyia aeterna,* new species
10. Body pale, or abdomen much paler than thorax.......................11
Thorax and abdomen blackish...15
11. Abdominal segments with posterior fringe of hairs; hind femora closely setose beneath; wings hyaline (male)........................... ....*Rhamphomyia tumulata,* new species
Not of this combination of characters..............................12
12. Hind tibiae of female not squamose.................................13
Hind tibiae of female heavily fringed on both edges with black scales; thorax blackish.................*Rhamphomyia interita,* new species
13. Thorax black...14
Thorax pale, with strong bristles; wings wide, pale flavescent, third vein greatly sinuous.................*Rhamphomyia craterae,* new species
14. Wings hyaline, discal cell one-third the length of the wing............. ....*Rhamphomyia spodites,* new species
Wings brownish, discal cell one-seventh the length of the wing.......... ....*Rhamphomyia sepulta* Cockerell
15. Length 7.8 mm.; body and legs with numerous setae; discal cell short and wide.....................*Rhamphomyia inanimata,* new species
Smaller species..16
16. Hind tibiae widely compressed and shaggy........................... ....*Rhamphomyia infernalis,* new species
Legs simple, body and legs virtually bare, the sparse hairs short.......17
17. Wings infumated.....................*Rhamphomyia fossa,* new species
Wings hyaline..18
18. Venter pale......................*Rhamphomyia morticina,* new species
Venter black.......................*Rhamphomyia senecta,* new species

Acallomyia probolaea, new species

Figure 45

FEMALE: Length 4.7 mm.; head 0.5, thorax 1.2, abdomen 3 mm. Body and legs wholly black, the abdomen as fossilized iridescent dark brown, paler than the legs. Antennae elongate, 0.6 mm. long, the first joint longer than the second, the third narrowly lanceolate, 0.21 mm. long, style measuring 0.125 mm.; proboscis sturdy, projecting straight forward 1 mm. beyond mouth opening. Metapleural setulae present. Legs slender, simple, hind femora 1.5 mm. long, hind tibiae 1.4 mm., with two apical setae, hind tarsi slender, 0.7 mm., the sole with small stiff hairs. Wings nearly hyaline, 3 mm. long by 1.2 mm. wide, veins fuscous, thin but firm, stigma obvious, filling end of marginal cell, basal cells short and coëxtensive, discal cell 0.75 mm. long by 0.25 wide, auxiliary vein parallel with first vein and evanescent midway the costal cell, first vein ending 1.2 mm. before level of wing tip, second vein ending 0.7 mm. beyond first vein, third vein recurved towards apex, ending at wing tip 0.7 mm. beyond second vein, its branch 0.3 and last section 0.55 mm., sections of fourth vein 0.2 : 0.55 : 1.45 mm., discal cell on second posterior 0.09, on third posterior 0.375, on fourth posterior cell 0.24 mm.

HOLOTYPE: A.M.N.H. No. 26603 from the Miocene shales, Florissant, Colorado, Station 14.

The neuration is almost exactly as in the recent *Acallomyia brunnea* (Coquillett), but the proboscis is much stouter and is stretched straight forward instead of pendant at an angle of about 45 degrees. The stiff projecting proboscis is suggestive of *Iteaphila*, but the small discal cell, steeply inclined posterior cross vein at the base of the third posterior cell, and presence of a group of metapleural hairs preclude relationship with that genus.

Probolaea, from Greek προβόλαιος, a spear held out before one.

Empis infossa, new species

Figure 49

FEMALE: Length 7.8 mm.; head 1 mm., thorax 1.35, abdomen 5.45. In dorsal view, apparently a dark species of normal build, with blackish legs and lightly infumated wings. Antennae elongate and slender. Body hairs not apparent; abdomen ending bluntly, two terminal styles visible. Legs simple, no bristles visible except the apical spurs of the tibiae, hairs microscopic; front femora measuring 1.4 mm. by 0.27 at middle, middle femora 1.35 mm. by 0.25, hind femora 2 mm. by 0.27; front tibiae 1.8 mm. by 0.12 at tip, middle tibiae 1.35 by 0.18, hind tibiae 2.15 by 0.2. Wings 6.2 mm. long, veins dark, stigma not indicated, second vein ending 2.5 mm. from fork with third, branch of third vein 1.4 mm. long.

HOLOTYPE: U.S.N.M. No. 112625 (R. D. Lacoe collection), from the Miocene, Florissant, Colorado.

The apical part of the left wing is apparently distorted so that there is an angulation in the third vein near the basal third of the first submarginal cell, the distal part then directed forward more than normal to collapse the second submarginal cell to a narrow wedge. The apical part of the right wing is not well enough preserved for checking.

Infossa, Latin, buried in the earth.

Rhamphomyia aeterna, new species

Figure 46

MALE: Length 6.4 mm.; head and thorax 2.8, abdomen 3.6; wing 4.5. Head and thorax black, abdomen dark brown, furnished with coarse black hairs which are especially prominent before the incisures where the hairs are one-third as long as the segments. Genitalia small and round in dorsal view, showing two arcuate blunt opposing valves 0.5 mm. long by 0.2 wide. Legs dark brown, with many short coarse hairs, under side of middle tibiae with a fringe of about 18 setae. Wings subhyaline, veins brown, prefurca very short and strongly curved, anal angle full, axillar excision broad and shallow. The following measurements are in microns: prefurca 120, distance between ends of second and third veins 810, the third vein gently curving to end at wing tip, apex of first posterior cell 550, of second posterior cell 525, sections of discal cell 330:540, the anterior cross vein opposite tip of second basal cell, discal cell on second posterior cell 110, on third posterior 460, on fourth posterior 320, on second basal cell 450.

HOLOTYPE: A.M.N.H. No. 26604, from the Miocene shales, Florissant, Colorado, Station 14.

The species seems to be very close to *Rhamphomyia hypolitha* Cockerell from the same locality but differs in the course of the third vein which swings closer to the second vein than in Cockerell's species.

Aeterna, Latin, everlasting.

Rhamphomyia craterae, new species

Figure 54

FEMALE: Length about 8 mm.; head 1, thorax 2.3, abdomen about 4.6; wing 4.8 by 2.2. A pale-colored species, probably testaceous in life. Antennae slender, base setulose, 0.75 mm. long, proboscis nearly three times the head height. Thorax with strong setae, i.e., humeral, notopleural, intra-alar, postalar, and six dorsocentrals. Abdominal hairs small and scattered. Legs coarsely hairy, simple, coxae setose, hind femora with some setae beneath, hind tibiae with at least one extensor seta at three-fifths. Wings with slight flavescent tinge, a little stronger around end of costal cell, the costa and first and third veins strong, light fuscous, the other veins weak; in microns the width of the marginal cell at end of first vein 200, width of submarginal cell at end of first vein 450, at end of second vein 500, first vein ending 2000 from level of wing tip, costal distance between first and second veins 900, straight line distance between end of second vein and the recurved end of third vein 1300.

HOLOTYPE: U.S.N.M. No. 112561 (R. D. Lacoe collection), from the Miocene shales, Florissant, Colorado.

Easily recognized by its relatively sigmoid third vein.

Craterae, Latin, of a volcano.

Rhamphomyia fossa, new species

Figures 51, 57

FEMALE: Length about 5.5 mm.; head 0.65, thorax 1.5, abdomen 3.4; wing 3.6 mm. Entirely black except the abdominal incisures and venter. Antennae with third joint lanceolate, 0.35 mm. long by 0.1 at base; proboscis slightly longer than height of head. Abdomen with the apical stylets developed. Legs simple, without evident bristles, hind tibiae 1.8 mm. long, scarcely thickened apically, tarsi slender. Wings moderately infumated, anterior veins fuscous, posterior veins very weak, stigma faint, third vein ending at tip of wing.

MALE: Enough like the female to be considered the same species. Genitalia forming a compact globular ending to the abdomen. Legs slender and simple.

TYPE MATERIAL: Holotype, female, U.S.N.M. No. 112567 (R. D. Lacoe collection), from the Miocene shales, Florissant, Colorado. Allotype, male, U.S.N.M. No. 112583, also from the Lacoe collection but bearing a different accessions number so possibly from another station.

The wings of both specimens overlap and thus preclude an analysis of the neuration.

Fossa, Latin, dug out.

Rhamphomyia inanimata, new species

Figure 56

MALE: Length 7.8 mm.; head 0.75, thorax 2.25, abdomen 4.8; wing 4.8 by 1.8. Body and legs shining black. Antennae with the third joint elongate lanceolate, 0.6 mm. long; proboscis at least one and a half times the height of head. Incisures of abdomen pale, hind margins of segments with full series of long setae, which measure about half the length of the integument, other hairs rather coarse; pygidium small, globular, not enlarging end of abdomen. Legs not abnormal, hind tibiae 2.25 mm. long, slightly and uniformly widening towards tip, with numerous extensor setae, the flexor surface closely setulose, hind metatarsi nearly as strong as the tibiae, 1.05 mm. long, with closely setulose sole. Wings moderately infumated, the basal half paler, darker along the stigma, veins fuscous. The following measurements are in microns: distance between ends of first and second veins 1050, between ends of second and third veins 1000, width of marginal cell at end of first vein 200, of submarginal cell 270, discal cell 1000 by 520, discal on first basal 325, on first posterior cell 675, on second posterior 150, on third posterior 480 and curved, on fourth posterior 400, on second basal 400, second vein strong, perpendicular width of submarginal cell at end of second vein 375, third vein gently curved and ending at wing tip, sections of fifth vein 400:1140, perpendicular width of first posterior cell opposite end of second vein 450.

Holotype: U.S.N.M. No. 112570 (countertype, U.S.N.M. No. 112586), R. D. Lacoe collection, from the Miocene shales, Florissant, Colorado.

Inanimata, Latin, lifeless.

Rhamphomyia infernalis, new species

Figure 47

Female: Length about 4.75 mm. A black species with enlarged hind tibiae. Occiput bristly; third antennal joint elongate and slender; proboscis at least as long as head. Vestiture of abdomen rather coarse, especially along posterior margins of segments. Anterior legs simple, no bristles visible on femora or tibiae but front coxae with hairs on anterior face, all femora with coarse short hairs, hind tibiae 1.8 mm. long by 0.3 wide including the fringe, the extensor edge with close narrow scales, hind metatarsi robust, 1 mm. long by 0.2 wide. Wings about 3 mm. long, subhyaline, anterior veins strong, posterior veins weak, stigma elongate.

Holotype: U.S.N.M. No. 112556 (R. D. Lacoe collection), from the Miocene shales, Florissant, Colorado.

There is a streak on the stone suggestive of a greatly reflexed branch of the third vein. As this is bent beyond the perpendicular it probably is extraneous and should not remove the species from *Rhamphomyia*. The tip of the other wing is defective, so the structure cannot be checked.

Infernalis, Latin, belonging to the regions below the earth's surface.

Rhamphomyia interita, new species

Figure 58

FEMALE: Length 6.75 mm.; head 0.75, thorax 2.1, abdomen 3.9; wing 4.2. Proboscis one-third longer than head height, inflexed. Thoracic bristles not evident, but at least two small scutellars. Abdomen paler than thorax, five incisures distinct, segments 6, 7, and 8 forming a widely conical and chitinized tip, vestiture consisting of scattered short black hairs. Anterior legs slender, coxae and femora fuscous, tibiae and tarsi blackish, hind femora moderately strong, progressively darker towards knee, the hairs fine and short, hind tibiae compressed, both edges strongly squamose, the fringes equal to the diameter of the tibia, hind metatarsi robust, about half as long as their tibiae, apparently not squamose. Wings probably hyaline, veins probably testaceous, weak, third vein ending before wing tip, simple.

HOLOTYPE: A.M.N.H. No. 26605, collected from the Miocene shales, Florissant, Colorado, at Station 14, by William M. Wheeler.

Interita, Latin, perished.

Rhamphomyia morticina, new species

Figures 50, 52

MALE: Length 6.5 mm. Piceous black, venter and incisures of abdomen paler. Antennae slender, about 720 μ in length, third joint lanceolate, three times as long as greatest width and slightly more than twice as long as the style; proboscis one-third longer than height of head. Costa and first, second, and third veins strong, the other veins weak, third vein ending at wing tip, costal sections proportioned 5:3:2, discal cell relatively short and wide, measuring 820 μ in length and 400 in width. Abdominal hairs sparse, short, and black; pygidium moderately large, somewhat higher than preceding segment, globular, valves and penis not indicated. Legs strong, not villose, front metatarsi fully as wide as their tibiae.

Female: Differs in having more slender legs, the front metatarsi not at all thickened. Antennae, proboscis, thorax, and abdomen as in the male. Wings apparently broad. Legs not scaled.

Types in the British Museum of Natural History, Department of Geology, Nos. I.7361 and I.7362, the male marked with study number 194, and the female 191. Miocene shales, Florissant, Colorado.

Morticīna, Latin, of an animal that has died.

Rhamphomyia senecta, new species

Figure 53

Male: Length about 6 mm.; head wanting, thorax 1.5 mm., abdomen 3.9. Wholly black, dorsum of thorax as preserved with some small but firm bristles. Abdomen with the incisures narrowly pale, vestiture consisting of sparse and short hairs, even along posterior margins of the segments; pygidium not larger than end of abdomen. Legs slender, hairs minute, no evident setae, but some very small bristles present under hind femora. Wings nearly hyaline, overlapping in the specimen so the neuration is confused, all veins fuscous, no stigma.

Holotype: A.M.N.H. No. 26606, collected by Sievert A. Rohwer from the Miocene shales, Florissant, Colorado.

This species resembles *Rhamphomyia morticina,* but has a smaller pygidium, and apparently the discal cell is longer and narrower.

Senecta, Latin, very old.

Rhamphomyia spodites, new species

Figure 55

Male: Length about 5.75 mm., the head and anterior portion of the thorax missing, abdomen 3 mm. Thorax blackish, abdomen pallid, provided with a few loose fine hairs along posterior margins of the segments and with scattered hairs. Anterior legs blackish, hind femora and tibiae yellowish, of normal structure, no bristles visible, hind tibiae and metatarsi very slender, the tibiae 1.35 mm. long. Wing about 4.5 mm., nearly hyaline, veins pale fuscous, thin. The following measurements are in microns: discal cell 1500 long, level of humeral cross vein to separation of second and third veins 600, end of second vein to end of third about 800, discal cell on first posterior cell 900, on second posterior cell 150, on third posterior cell 360, on first basal cell 550.

HOLOTYPE: A.M.N.H. No. 26607, from the Miocene shales, Florissant, Colorado, Station 14.

Spodites, Greek *σποδίτης*, baked in ashes.

Rhamphomyia tumulata, new species

Figure 48

MALE: Length 6.1 mm.; head 0.55, thorax 1.85, abdomen 3.75; wing 3.8. Head, thorax, and legs blackish, abdomen nearly colorless but with a narrow middorsal basal dark stripe extending halfway to the light fuscous globular genitalia. Chaetotaxy of head and thorax not evident, but abdomen with scattered, rather long black hairs which become definitely long as they fringe the posterior borders of the segments. Legs not abnormal, rather slender, the hind femora beneath with a close row of about 22 setae and the hind tibiae finely setulose underneath. Third antennal joint lanceolate; proboscis short, scarcely longer than height of head. Wings nearly hyaline, possibly in life with a slight flavescent tinge, veins light brown, third vein gently curving to wing tip.

HOLOTYPE: A.M.N.H. No. 26608, collected by William M. Wheeler from the Miocene shales, Florissant, Colorado, Station 14.

When first uncovered the insect appeared to have remarkable porrect palpi. However, the structure is extraneous, possibly part of a spider's leg.

Tumulata, Latin, entombed.

Tachypeza primitiva, new species

Figure 59

MALE: Length 7 mm.; head 0.75, thorax 1.8, abdomen 4.5. Head and thorax black, abdomen dark brown, the pale incisures prominent, genitalia blunt. Posterior legs simple, the femora yellowish, tibiae and tarsi progressively blackened, front legs raptorial and blackish, front coxae long and strong, 0.9 mm. in length, front femora robust, 1.2 mm. in length. Wings narrow, about 5 by 1.45 mm., veins thick and blackish on the dark portion of the wing, approximately the apical half infumated, the picture extending from the end of the costal cell diagonally across the fork of the second and third veins, second vein 1.5 mm. long, prefurca 1.2, anterior cross vein 0.25, located 0.15 beyond the fork of the second and third veins, distance between ends of first and second veins 0.7, between second and third veins 0.75, between third and fourth veins 0.3.

HOLOTYPE: U.S.N.M. No. 112566 (R. D. Lacoe collection), from the Miocene shales at Florissant, Colorado.

Primitiva, Latin, the earliest of its kind.

SYRPHIDAE

Platycheirus lethaeus, new species

Figure 44

FEMALE: Length 7 mm. Head and thorax including scutellum wholly black (the shining carbonization abraded on much of the mesonotum), abdomen with broad yellow fasciae, hind legs black, middle femora brown. Head parts crushed, with only the distorted base of the black antennae visible. Scutellum semicircular. Abdomen narrowly ovate, first segment wholly black, second segment black on posterior two-fifths, in front of which the large quadrate corners are yellow and the middle portion is black and tapers slightly to its junction with the posterior band; third segment widest, yellow on anterior three-fifths, black behind, with an indication of a median dark stripe; fourth segment similar to third, the yellow portion a little more extensive; fifth and sixth segments yellowish. Wings clear hyaline, 5.5 mm. long, anterior cross vein slightly inclined, located 0.5 mm. beyond base of discal cell.

HOLOTYPE: Miocene shales, Florissant, Colorado, discovered by Junius Henderson and Francis Ramaley at the northwest corner of Fossil Stump Hill (University of Colorado No. 19899).

As the specimen is a female it is impossible to state with certainty that it is a *Platycheirus*, since the genus is based on peculiarities of the legs of the males. However, the broad yellow markings of the abdomen are more like those of modern females of *Platycheirus* than conforming to the pattern of *Melanostoma*, where the pale spots tend to become triangular. A specimen from Station 14, discovered by S. A. Rohwer (A.M.N.H. No.

26610), appears to belong here. It is exposed in ventral view. A bit of the front or middle tarsus is seen to be widened. The hind femora are black. The abdomen is somewhat broader than in the type but presents the same color pattern, with the fifth segment brownish, the sixth segment not visible.

Lethaeus, Latin, belonging to the lower regions of the earth.

PHORIDAE

Phora laminarum Brues

Figure 61

MALE: Length about 3.5 mm.; head 0.45, thorax 1.1, abdomen 2 mm. Color ferruginous, pleura and legs yellow. Mesonotum covered with fine appressed setulae, the supra-alar and scutellar bristles strong; no abdominal hairs. Middle tibiae with two long terminal spurs; hind legs as figured by Brues, showing the dorsal series of transverse rows of setulae, the two long apical tibial spurs, and the two dorsal longitudinal rows of contiguous setulae. Wings not preserved.

One specimen (A.M.N.H. No. 26611) from Station 14, the type locality, Miocene shales at Florissant, Colorado, is slightly smaller than the type and may have one or two fewer whorls of setulae on the hind tibiae.

Phora cockerelli Brues

A female in the National Museum collection from R. D. Lacoe, from the Florissant shales, numbered 154, may well be included in Brues' species. Although the bristles of the legs have not been preserved, the hind metatarsi show the longitudinal rows of fine setulae as in the type, which also was discovered at Florissant. The antennae are not evident, but there is a faint indication of the wings, and altogether the specimen agrees very closely with Brues' original figure.

Phora, sensu lato, **tumbae,** new species

Figure 60

Total length 4.2 mm.; head 0.4, thorax 1.5, abdomen about 2.4 mm. Head and thorax black, abdomen dark brown, the sclerites separated by light-colored membrane, the pale bands nearly as wide as the dark tergites; legs apparently testaceous in life, the hind femora enormously enlarged, front femora measuring 1000 by 375 μ, middle femora 1375 by 475, hind femora 2200 by 1200; front tibiae 850 by 150, slightly curved and apparently compressed; middle tibiae 1050, fusiform, greatest width 240 at two-thirds the length, finely microscopically setulose and with a subdorsal close row of minute black setules, and with a long terminal spur present; hind tibiae 1600, compressed and curved, no bristles or setulae visible; front metatarsi much more slender than the tibiae, middle metatarsi flattened, with two widely separated dorsal rows of close-set setulae. Wings represented by only a vague indication of the root.

HOLOTYPE: A.M.N.H. No. 26612, from the Miocene shales, Florissant, Colorado, Station 14.

The two species of Phoridae described by Brues from Florissant differ from *tumbae* in the structure of the legs. The characteristic bristles are not preserved on the present specimen, only a few reclinate bristles being visible over the vertex. It is impossible to assign the species to any of the modern subdivisions of *Phora*.

Tumbae, Latin, from the grave.

ANTHOMYIIDAE

MECISTONEURON, NEW GENUS

Size small. Auxiliary vein distinct from first vein, ending near middle of wing, first vein ending well towards tip, in the usual position of the second vein, apical half of first three veins almost parallel, third vein ending at wing tip, fourth vein divergent, anterior cross vein almost at base of wing. Abdomen longer than wings, conically pointed. Tibiae apparently compressed. Details of chaetotaxy, leg structure, and anal field of wings not preserved.

Although the specimen lacks so many taxonomic characters that its exact location in the family cannot be stated, it is unique in its abbreviated first basal cell and in having a much larger first vein than any fly with which it could be confused, and hence it deserves a name *sui generis*.

GENOTYPE: The following species.

Mecistoneuron perpetuum, new species

Figure 63

FEMALE: Length of head 0.6 mm., thorax 1.5, abdomen 3.1; wings 3.3 by about 1.3 mm. Entirely black, wings hyaline, veins fuscous. Auxiliary vein ending 1400 μ from root of wing, first vein ending 1150 from auxiliary and 750 from level of tip, straight-line distance between ends of first and second veins 750, between second and third veins 290, and between ends of third and fourth veins 480, prefurca 300, anterior cross vein 210 beyond prefurca and 300 before level of end of auxiliary vein, i.e., 1350 before end of first vein, width of marginal cell at end of first vein 200, of submarginal cell 210, of first posterior cell 390.

HOLOTYPE: A.M.N.H. No. 26613, from the Miocene shales, Florissant, Colorado, Station 13.

Mecistoneuron, Greek, μήκιστον, the longest, plus νεῦρον, vein; *perpetuum*, Latin, for all time.

Ophyra vetusta, new species

Figure 64

Length, head and thorax together, 2 mm., abdomen 1.65 by 0.9, wing 2.7 by 0.95. Polished black; chaetotaxy destroyed, some scattered and disturbed coarse black hairs present on abdomen, the longest of which are about one-third the length of the segments; legs apparently blackish; wings hyaline, veins brown, the auxiliary vein ending 1200 μ from root of wing and 330 before end of first vein, first vein ending slightly beyond middle of wing, marginal cell 1050 along costa, prefurca 280, third vein ending at wing tip, sections of fourth vein proportioned 670:360:860 μ, anterior cross vein at middle of wing, and its length 100, posterior cross vein 310, anal cross vein 150, width of first posterior cell at middle 250, at tip 180, length of anal cell 350; calypteres not showing.

HOLOTYPE: A.M.N.H. No. 26614, from the Miocene shales at Florissant, Colorado, collected by Sievert A. Rohwer at Station 12.

The fly is most beautifully delineated in a spot of white marble on the drab shale.

The assignment of this species to the genus *Ophyra* is provisional. The absence of distinctive bristles makes it impossible to determine which of the multitude of modern anthomyiid genera, if any, should include the fossil. Although the species is small, its size need not exclude it from this complex group. The main reasons for locating it with *Ophyra* are the highly polished black body, setulose abdomen, freely ending auxiliary vein, lengthened first vein, long, narrow, parallel-sided first basal cell, relatively long truncate anal cell, and slight forward curvature of the end of the fourth vein. In size the species suggests an acalypterate, but this combination of characters excludes it from each of the present-day families.

Vetusta, Latin, from ancient times.

LAUXANIIDAE

Sapromyza veterana, new species

Figure 67

Length 3.5 mm., head and thorax about 2, abdomen 2.4; wing 3.6 by 1.4. Apparently a yellowish insect in life, the coloration as preserved a light fuscous, wings flavescent. On the head two fronto-orbital and a pair of widely separated vertical bristles are present, indicating a wide separation of the eyes, but the antennae are not indicated. Of the thoracic bristles the humeral, one dorsocentral, one supra-alar, and the apical scutellars remain. Middle tibiae with strong pre-apical, hind tibiae with a smaller pre-apical. A seta present at base of costa. The first vein appears to end 1.5 mm. from the base of wing, the second vein almost at wing tip, third vein at extreme apex. The location of the cross veins is too vague to measure.

HOLOTYPE: U.S.N.M. No. 112557 (R. D. Lacoe collection), from the Miocene shales, Florissant, Colorado.

Although the specimen is but weakly depicted and lacks many of the supporting characters for definite placement in the genus *Sapromyza, sensu lato*, it presents the general habitus of such a species as the modern *Minettia flaveola*.

Veterana, Latin, old.

OTITIDAE (ORTALIDIDAE)

Melieria (Ceroxys) calligrapha, new species

Figure 62

MALE: Length about 7 mm., the end of the abdomen is curled under, so the fossil appears shorter than it actually is; head and thorax 3.5 mm., wing nearly 6 mm. Entire body and legs quite black. Mouth parts extruded, as long as head, thick. Wings in general hyaline, but marked with large brown spots, i.e., a broad transverse band extending from the costa across base of submarginal cell and anal cross vein, narrowing behind, a large spot surrounding the anterior cross vein and vaguely connected with the dark end of the costal cell, a large spot surrounding the posterior cross vein, and an apical band beginning much before end of marginal cell opposite the posterior cross vein and extending to the tip of the fourth vein. Length of anterior cross vein 400 μ, discal cell on first basal 1350, on first posterior 900, posterior cross vein 750, base of discal cell to end of anal about 400.

Although no bristles show on the anterior part of the thorax, the wing pattern is so characteristically like that of existing species of *Melieria* that the species finds its best location in this genus.

HOLOTYPE: A.M.N.H. No. 26615, from the Miocene shales, Florissant, Colorado, discovered by William M. Wheeler at Station 14.

In its strikingly pictured wings the species presents a close resemblance to *Melieria atavina* Cockerell, also from Florissant shales. But it differs markedly in the location of the anterior cross vein, the formation of the anal cell, and absence of the basal spot of the wing. Cockerell's species has the anterior cross vein at almost the apical fourth of the discal cell and the anal cell considerably shorter than the second basal. In *calligrapha* the anterior cross vein is but slightly beyond the middle of the discal cell, and the second basal and anal cells are coëxtensive.

Calligrapha, Greek, beautifully pictured.

SEPSIDAE

Themira saxifica, new species

Figure 65

FEMALE: Length 4.3 mm.; head and thorax 2.4, abdomen 2.5 by 1.8; wing 3.5 by 0.5. Entirely black, shining, wings hyaline, veins brown; only a very few short abdominal hairs preserved. First vein ending 1850 μ from level of tip of wing and 500 beyond end of auxiliary vein, second vein measuring 2400 to prefurca which is 350 long, third vein 2750, front edge of discal cell 830 to cross vein and 670 beyond it, last section of fourth vein 1200 and angled at posterior cross vein, length of anterior cross vein 200, of posterior cross vein 400, width of first posterior cell at end of fourth vein 320, width of submarginal cell at end of second vein 320.

HOLOTYPE: A.M.N.H. No. 26616, from the Miocene shales at Florissant, Colorado, collected by Sievert A. Rohwer at Station 11.

A second specimen, A.M.N.H. No. 26616/1 from Station 13, shows the antennae, the third joint of which is twice as long as deep, apically rounded and with the slender bare arista arising well towards base; the anal cell is about 450 μ long, with the cross vein just basad the end of the second basal cell, at first rounded and then reflexed.

The species has the general habitus of *Themira*, but since its bristles are not preserved its location in that genus cannot be stated with finality. The first vein is somewhat longer than in the modern species, but that seems to be a general characteristic of the Tertiary acalypterates. In the lengthened third antennal joint the species departs from recent themiras, which have this joint short and globular, and approaches *Sepsis*. It would seem that the lengthened antennae of *Sepsis* represent the generalized condition, but its short costal and subcostal cells are more specialized than the lengthened ones of *Themira*.

Saxifica, Latin, turned into stone.

PIOPHILIDAE

Mycetaulus incretus, new species

Figure 69

FEMALE: Length of head and thorax 2.4 mm., of the deflexed abdomen about 2.7; wing 3.45 by 1.45 mm. Apparently black over all, anterior legs yellowish, hind legs fuscous but yellowish at base; wings hyaline, the apical sixth broadly infumated but the mark gradually merging proximally. Discal cell acuminate at base. The following alar measurements are in microns: length of first vein 1800, second vein from prefurca 2400, third vein 2840, width of costal cell at middle 210, width of marginal cell at end of first vein 300, width of submarginal cell at end of first vein 225, at apex of second vein 360, length of prefurca 340, length of anterior cross vein 180, of posterior cross vein 450, sections of fourth vein 840:800:1200, sections of fifth vein 1650:240, apical width of first posterior cell 360.

HOLOTYPE: A.M.N.H. No. 26617, from the Miocene shales, Florissant, Colorado, Station 13.

The dark cloud at the apex of the wing suggests the genus *Mycetaulus*, but the absence of bristles makes it impossible to pronounce with certainty that the fossil belongs to this genus. The insect closely resembles the modern *Mycetaulus polypori*

Melander, but is larger, darker, has broader wings, with slightly different proportions to the sections of the veins. The existing species of *Mycetaulus* vary as much in wing structure and neuration and in range of color, though all are smaller than the Tertiary species.

Incretus, Latin, covered by sifting ashes.

TRICHOSCELIDAE

Trichoscelis patefacta, new species

Figure 71

Head and thorax 1.8 mm., abdomen about 2, wing 3 mm. Quite like the present-day species of *Trichoscelis*, with the costa furnished with nearly uniform spines. Some of the characteristic macrochaetae and scattered mesonotal setulae retained, including the oral vibrissa and the apical spine on the hind tibia. Alar measurements in microns: end of first vein from humeral cross vein 750, end of auxiliary vein to end of first vein 260, length of second vein from point below end of first vein 1800 or from prefurca 2350, length of third vein from prefurca 2600, distance between tips of second and third veins 500, upper side of discal cell to anterior cross vein 600, from anterior to posterior cross vein 720, width of first posterior cell at end of discal 360, first posterior cell on second posterior 1150.

HOLOTYPE: A.M.N.H. No. 26618, from the Florissant shales at Station 13, found by William M. Wheeler.

The species apparently closely resembles *Heteromyella miocenica* Cockerell, but it is much smaller and has smaller wings, with the first vein relatively shorter and largely fused with the auxiliary vein, and with the anterior cross vein located beyond the end of the first vein and before the middle of the discal cell. *Heteromyella* appears to be a true helomyzid, but the present species belongs to the Trichoscelidae.

Patefacta, Latin, brought to light.

AGROMYZIDAE

Agromyza praecursor, new species

Figure 70

FEMALE: Length about 4 mm.; head and thorax 1.8, abdomen 2.2 A black, bristly species with large antennae; fossilized in profile, the right wing pressed against the abdomen so as to obscure the neuration and the distal part of the wing broken off. Antennae much as in the modern *Agromyza luctuosa* Meigen, the third joint deeply rotund. Four dorsocentral bristles visible, as well as notopleural, intra-alar, apical, and lateral scutellars. Interstices of abdomen narrowly light colored, with a transverse row of bristles just before the bands.

HOLOTYPE: A.M.N.H. No. 26619, from the Miocene shales at Florissant, Colorado, Station 14, discovered by William M. Wheeler.

The species is so much like *Agromyza luctuosa* Meigen (= *magnicornis* Loew, North America, and *grossicornis* Zetterstedt, Europe) that the difference in their ages seems incredible.

Praecursor, Latin, a forerunner.

Melanagromyza prisca, new species

Length 2.8 mm. Thorax and abdomen shining black, front and vertex brownish, wings hyaline, veins fuscous. Wings 2.4 by 1.08 mm. The following data are in microns: costa broken at end of first vein 870 from base, second vein ending 1230 beyond first vein, distance between ends of second and third veins 330, costa continuing beyond tip and probably to fourth vein (the fossil abraded at this place), prefurca about 200, anterior cross vein well beyond end of first vein, 400 from prefurca, sections of fourth vein 450:400:750, sections of fifth vein 930:420, length of anterior cross vein 90, of posterior cross vein 300.

HOLOTYPE: A.M.N.H. No. 26620, from the Miocene shales at Florissant, Colorado, Station 4.

The fossil shows a little black lump on the right side, where the knob of the halteres should be. For this reason the species is placed in Hendel's genus *Melanagromyza* rather than in *Agromyza, sensu lato.*

Prisca, Latin, belonging to former times.

Melanagromyza tephrias, new species

Figure 66

FEMALE: Length 3.75 mm., the head and thorax about 1.8, the abdomen about 1.95 mm. Apparently a black species with yellow legs, the abdomen with pale interstitial bands. The fly is preserved in profile view, but the wings are pressed together so as to obscure the measurement of parts. There is a small blackened knob at the place where the halteres should be; hence the generic placement in *Melanagromyza*. The costa is continued beyond the end of the third vein.

HOLOTYPE: A.M.N.H. No. 26621, from the Miocene shales, Florissant, Colorado, Station 4.

Although the specimen does not contribute much information it establishes the existence of yellow-legged agromyzas in the Tertiary.

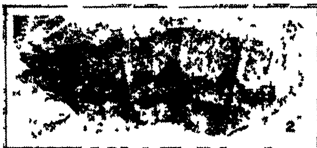
Tephrias, Greek *τεφρίας*, a stone formed of ashes.

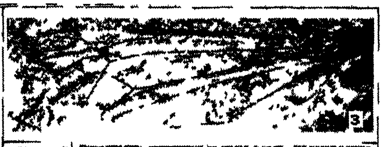
MUSCOID PUPARIUM

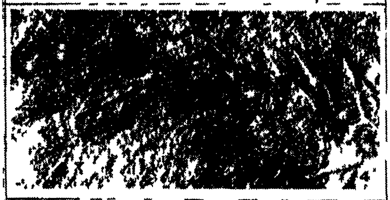
Figure 68

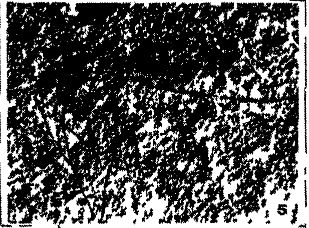
Two coarctate puparia were discovered at Station 4, marked A.M.N.H. Nos. 26622:1, 26622:2. They measure 5 by 2.5 mm., are dark brown in color and show about 12 somites. They are bare, not wrinkled along the interstices, and possess no definite protuberances, tubercles, button, or cavities. At the posterior end No. 26622:2 shows a small, shallow, oval, unchitinized pit, but paired spiracular plates are not evident. At the rear of this pit are four or five small, black, chitinized points directed inward.

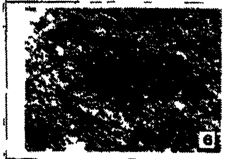
The systematic location of these puparia is doubtful, so they are merely enumerated here without name.

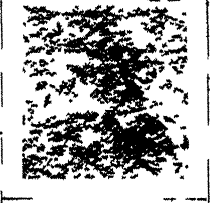


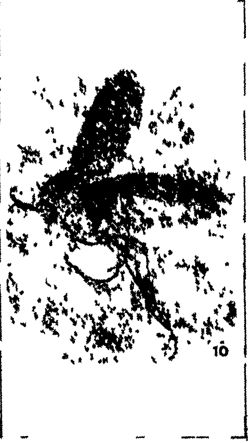


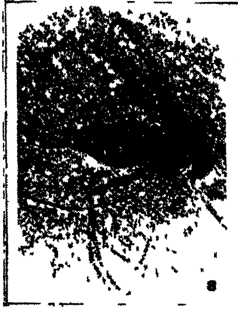












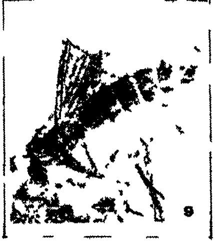


FIG. 2. *Tipula wilmatteae*, new species, original size 14 mm., holotype, A.M.N.H. No. 26452. Tipulidae.

FIG. 3. *Tipula florissanta* Scudder, length of wing 18 mm., A.M.N.H. No. 26453. Tipulidae.

FIG. 4. *Diamesa extincta*, new species, length of wing 4 mm., holotype, A.M.N.H. No. 26467 Chironomidae.

FIG. 5. *Proapemon infernus*, new genus, new species, length 6 mm., holotype, A.M.N.H. No. 26463. Mycetophilidae.

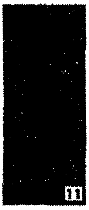
FIG. 6 *Sciara dormitans*, new species, length 4.2 mm., holotype, A.M.N.H. No. 26464. Sciaridae.

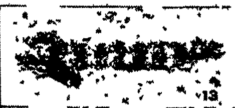
FIG. 7. *Sciara requieta*, new species, length 4.2 mm., holotype, A.M.N.H. No. 26465. Sciaridae.

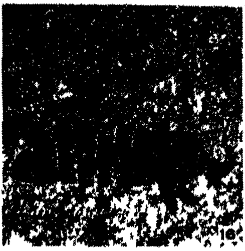
FIG. 8. *Sciara sopora*, new species, length 3.5 mm., holotype, A.M.N.H. No. 26466. Sciaridae.

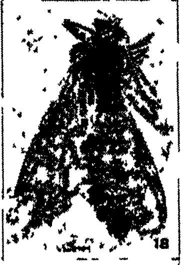
FIG. 9. *Exechia priscula*, new species, length 5.5 mm., holotype, A.M.N.H. No. 26462. Mycetophilidae.

FIG. 10. *Boletina hypogaea*, new species, length 5.1 mm., holotype, U.S.N.M. No. 112571. Mycetophilidae.









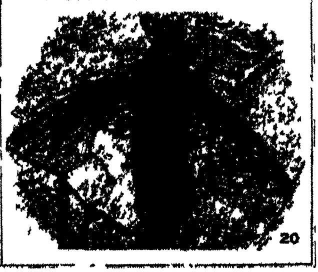


FIG. 11. *Chironomus proterus*, new species, male, length 5.5 mm., holotype, Br.M.N.H. No. I. 7359. Chironomidae.

FIG. 12. *Chironomus proterus*, new species, female, length 6.3 mm., allotype, Br.M.N.H., No. I. 7358. Chironomidae.

FIG. 13. *Chironomus requiescens*, new species, pupa, length 9 mm., holotype, A.M.N.H. No. 26171:1. Chironomidae.

FIG. 14. *Chironomus pausatus*, new species, pupa, length 6.5 mm., holotype, A.M.N.H. No. 26173. Chironomidae

FIG. 15. *Chironomus primaevus*, new species, length 7 mm., holotype, A.M.N.H. No. 26169:1. Chironomidae.

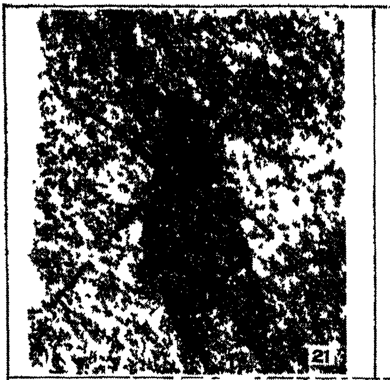
FIG. 16. *Reichertella fasciata*, new species, length 3.8 mm., holotype, U.S.N.M. No. 112563. Scatopsidae.

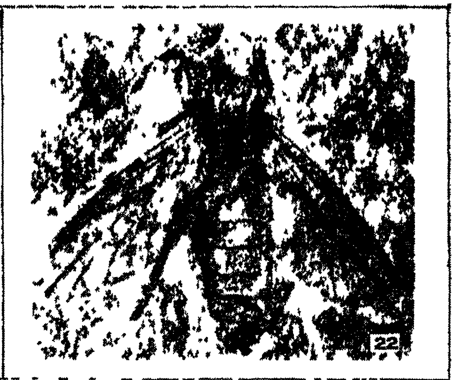
FIG. 17. *Hesperinus immutabilis*, new species, length 9 mm., paratype, U.S.N.M. No. 112588. Bibionidae.

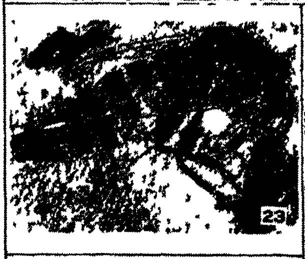
FIG. 18. *Penthetria longifurca*, new species, length 9.25 mm., holotype, U.S.N.M. No. 112551. Bibionidae.

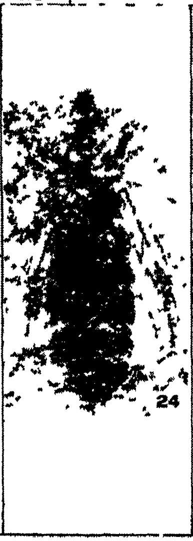
FIG. 19. *Plecia gradata*, new species, length 11.5 mm., holotype, A.M.N.H. No. 26481. Bibionidae.

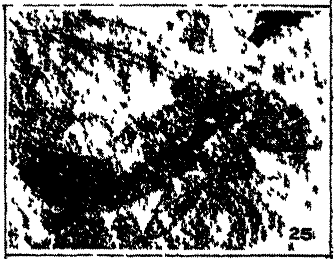
FIG. 20. *Plecia tessella*, new species, length 11 mm., holotype, U.S.N.M. No. 112562. Bibionidae.

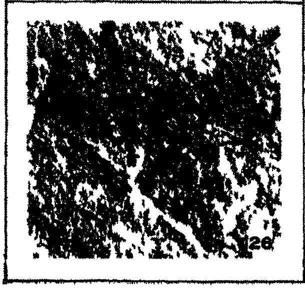












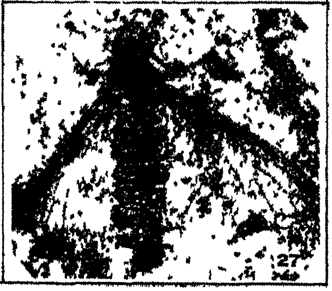


FIG. 21. *Plecia orycta*, new species, length 7.7 mm., holotype, U.S.N.M. No. 112569. Bibionidae.

FIG. 22. *Bibio wickhami* Cockerell, length 13 mm , A.M.N H. No 26490/2: 1 Bibionidae

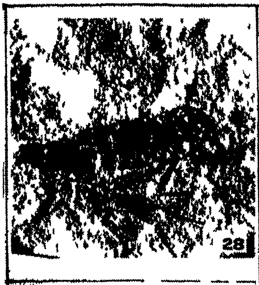
FIG. 23. *Bibio cockerelli* James, length 8 mm., graphotype, A M N H. No. 26484/2: 1. Bibionidae

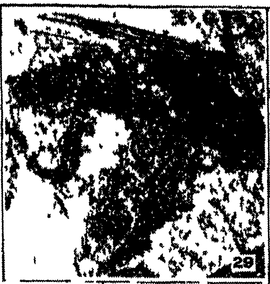
FIG. 24. *Bibio cockerelli* James, length 11 mm , graphotype, U.S.N M No. 112585. Bibionidae.

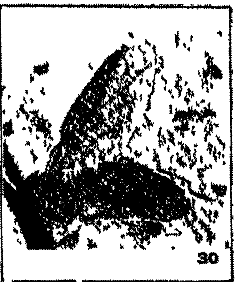
FIG. 25. *Bibio podager*, new species, length 8 mm., holotype, A M.N.H. 26487. Bibionidae.

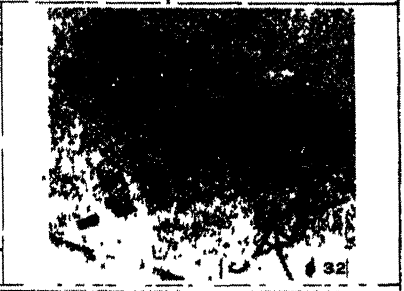
FIG. 26. *Bibio jamesi*, new species, length 7 mm., holotype, A.M.N.H No. 26486. Bibionidae.

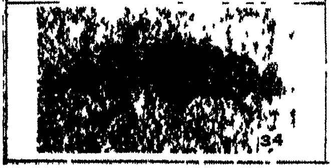
FIG. 27. *Bibio excurvatus*, new species, length 7.75 mm , holotype, U.S.N.M. No. 112550. Bibionidae.











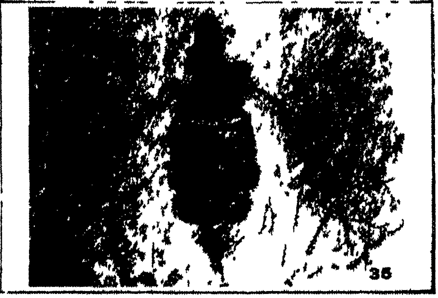


Fig. 28. *Bibio explanatus*, new species, length 11.5 mm., holotype, A.M.N.H. No. 26485. Bibionidae.

Fig. 29. *Bibio vulcanius*, new species, length 9 mm., holotype, U.S N.M. No. 112564. Bibionidae.

Fig. 30. *Bibio capnodes*, new species, length 9 mm. without head, holotype, U.S.N.M. No. 112565. Bibionidae.

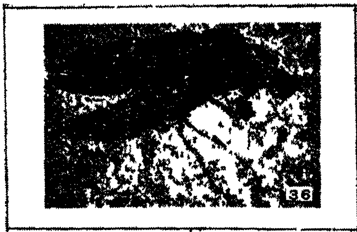
Fig. 31. *Rhagio fossitius*, new species, length 7 mm., holotype, U S.N.M. No. 112626. Rhagionidae.

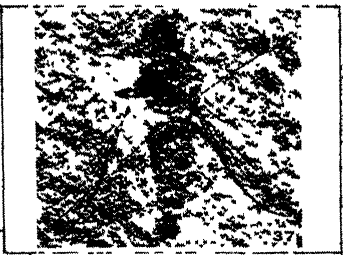
Fig. 32. *Rhagio wheeleri*, new species, length 9 mm., paratype graphotype, A.M.N.H. No. 26496:2. Rhagionidae.

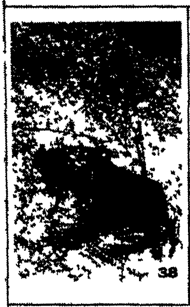
Fig. 33. *Solva* (*Xylomyia*) *inornata*, new species, length 9.5 mm , holotype, U.S.N.M. No. 112568. Rhagionidae.

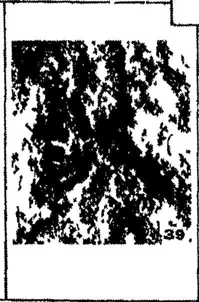
Fig. 34. *Dialysis revelata* Cockerell, length 19 mm., A.M.N.H. No. 26495. Rhagionidae.

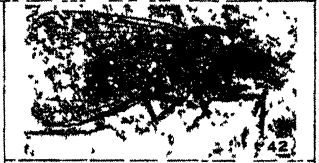
Fig. 35. *Neorhynchocephalus occultator* (Cockerell), length 19 mm., A.M.N.H. No. 26497. Nemestrinidae.

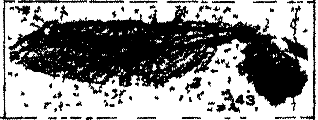


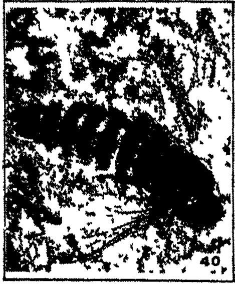


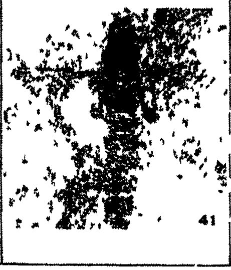












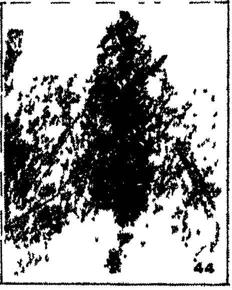


FIG. 36. *Nebritus willistoni*, new species, length 6.5 mm., holotype, U.S.N.M. No. 112553. Therevidae.

FIG. 37. *Amphicosmus delicatulus*, new species, length 4.85 mm. countertype, A.M.N.H. No. 26600A. Bombyliidae.

FIG. 38. *Protophthiria atra*, new species, length 7.5 mm., holotype, U.S.N.M. No. 112552. Bombyliidae.

FIG. 39. *Alepidophora minor*, new species, length 6.75 mm., holotype, A.M.N.H. No. 26498. Bombyliidae.

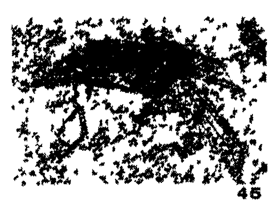
FIG. 40. *Alepidophora cockerelli*, new species, length 9.25 mm., holotype, A.M.N.H. No. 26499. Bombyliidae.

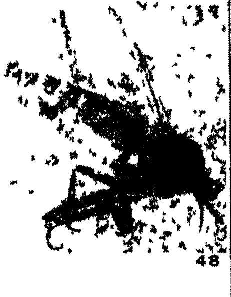
FIG. 41. *Melanderella testea*, new species, length 9.5 mm., holotype, U.S.N.M. No. 112553. Bombyliidae.

FIG. 42. *Apolysis magister* Melander, length 6.25 mm., paratype, U.S.N.M. No. 112573. Bombyliidae.

FIG. 43. *Senoprosopis eureka*, new species, length of wing 13 mm., holotype, A.M.N.H. No. 26602. Asilidae.

FIG. 44. *Platycheirus lethaeus*, new species, length 7 mm., holotype, Univ. Colorado No. 19899. Syrphidae.





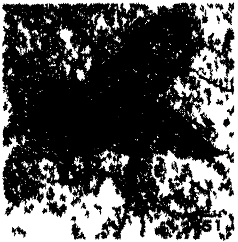


Fig. 45. *Acallomyia probolaea*, new species, length 4.7 mm., holotype, A.M.N.H. No. 26603. Empididae.

Fig. 46. *Rhamphomyia aeterna*, new species, length 6.4 mm, holotype, A.M.N.H. No. 26604. Empididae.

Fig. 47. *Rhamphomyia infernalis*, new species, length 4 75 mm., holotype, U.S.N.M. No 112556 Empididae.

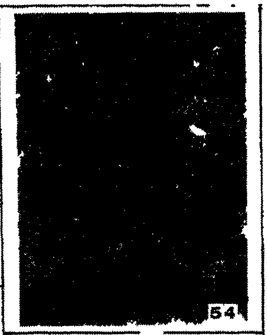
Fig. 48 *Rhamphomyia tumulata*, new species, length 6.1 mm, holotype, A.M.N.H. No. 26608 Empididae.

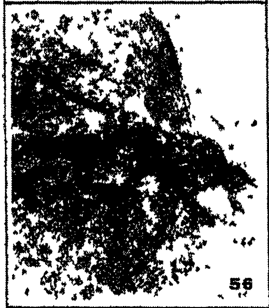
Fig. 49 *Empis infossa*, new species, length 7.8 mm., holotype, U.S N.M. No. 112625. Empididae

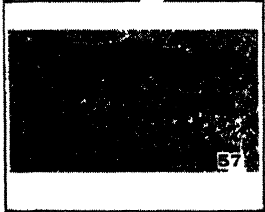
Fig. 50. *Rhamphomyia morticina*, new species, length 6 5 mm , type (female), Br.M.N H No. I. 7361. Empididae.

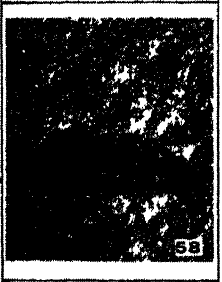
Fig. 51. *Rhamphomyia fossa*, new species, length 5.5 mm , holotype (female), U.S.N.M. No. 112567. Empididae

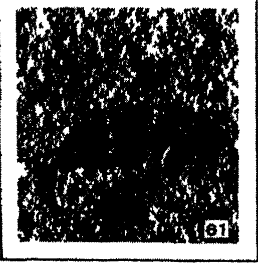
Fig. 52. *Rhamphomyia morticina*, new species, length 6.5 mm., type (male), Br.M.N.H No I 7362 Empididae.











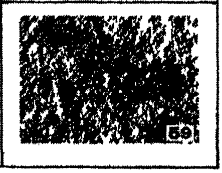


FIG. 53 *Rhamphomyia senecta*, new species, length 6 mm, holotype, A.M.N.H. No. 26606 Empididae.

FIG. 54 *Rhamphomyia craterae*, new species, length 8 mm, holotype, U.S N.M. No 112561. Empididae.

FIG. 55 *Rhamphomyia spodites*, new species, length 5 75 mm., holotype, A.M.N.H. No. 26607. Empididae.

FIG. 56. *Rhamphomyia inanimata*, new species, length 7.8 mm, countertype, U.S.N.M. No. 112586. Empididae.

FIG. 57. *Rhamphomyia fossa*, new species, length 4.7 mm., allotype (male), U.S.N.M. No. 112583. Empididae.

FIG. 58. *Rhamphomyia interita*, new species, length 6.75 mm., holotype, A.M N.H. No. 26605. Empididae.

FIG. 59. *Tachypeza primitiva*, new species, length 7 mm., holotype, U.S.N.M. No. 112566. Empididae.

FIG. 60. *Phora tumbae*, new species, length 4.2 mm., holotype, A.M.N.H. No. 26612. Phoridae.

FIG. 61. *Phora laminarum* Brues, length 3.5 mm., graphotype, A.M.N.H. No. 26611. Phoridae.

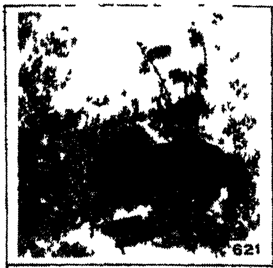
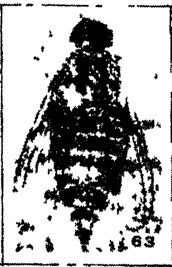
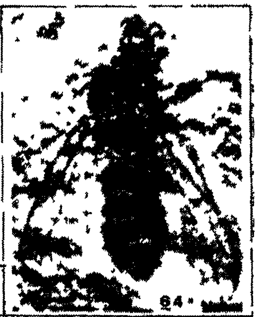
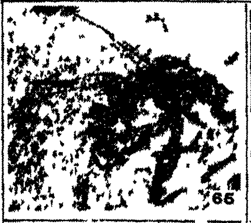
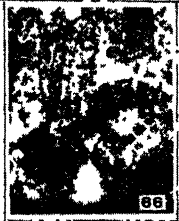
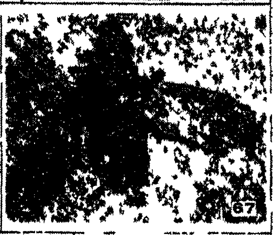
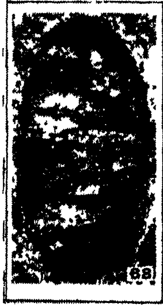
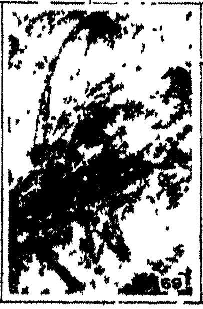
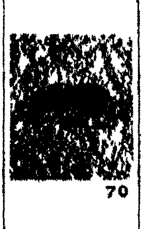
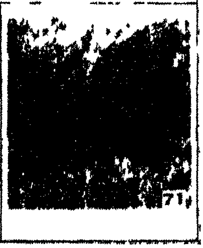











FIG. 62. *Melieria* (*Ceroxys*) *calligrapha*, new species, length 7 mm., holotype, A.M.N.H. No. 26615. Otitidae.

FIG. 63. *Mecistoneuron perpetuum*, new genus, new species, length 5.2 mm., holotype, A.M.N.H. No. 26613. Anthomyiidae.

FIG. 64. *Ophyra vetusta*, new species, length 3.65 mm., holotype, A M.N.H. No. 26614. Anthomyiidae.

FIG. 65. *Themira saxifica*, new species, length 4.3 mm., paratype, A.M.N.H. No. 26616/1 Sepsidae.

FIG. 66. *Melanagromyza tephrias*, new species, length 3.75 mm., holotype, A.M.N.H. No. 26621. Agromyzidae.

FIG. 67. *Sapromyza veterana*, new species, length 3 5 mm., holotype, U.S. N.M. No. 112557. Lauxaniidae.

FIG. 68. Muscoid puparium, size 5 by 2.5 mm., A.M.N.H. No. 26622:2.

FIG. 69. *Mycetaulus incretus*, new species, length 5 mm., holotype, A.M.N.H. No. 26617. Piophilidae.

FIG. 70. *Agromyza praecursor*, new species, length 4 mm., holotype, A.M. N.H. No. 26619. Agromyzidae.

FIG. 71. *Trichoscelis patefacta*, new species, length 1.8 mm., holotype, A.M. N.H. No. 26618. Trichoscelidae.

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A FOSSIL DEPOSIT IN A CAVE IN ST. LOUIS

BY GEORGE GAYLORD SIMPSON

INTRODUCTION

This paper describes a discovery of fossil bones in a cave in the city of St. Louis, Missouri. The presence of a rich deposit of fossil mammals in the midst of a great city is, in itself, of interest. The nature of the deposit is also unusual and has considerable geological interest, even though inferences as to its origin are necessarily somewhat speculative. The fauna as now known includes no striking novelties, but one member, a woodchuck, represents a hitherto unknown subspecific group to which a name, *Marmota monax hessi*, is given in this paper. A large extinct armadillo, although not a new species, is the most unusual member of the fauna and sets a new record for the northward extension of armadillos. The great majority of the fossils represent the common Pleistocene peccary *Platygonus compressus*. The large series of remains of this animal obtained from the cave in St. Louis permits study of variation in this species and notes on its status and the status of some related forms.

This fossil deposit was discovered by Mr. Lee Hess, the owner of the cave. In the course of clearing out clay-filled passages, he noticed bones in this filling and sent them to the American Museum for identification. Finding that we were interested in further investigation, Mr. Hess invited us to visit St. Louis and work in the cave. George O. Whitaker, of our fossil vertebrate laboratory, and I spent the latter part of March, 1946, on this interesting task. Mr. Hess provided us with living quarters in the old De Menil mansion, above the cave, and also provided workmen to assist us and helped us in innumerable other ways. I cannot too strongly express our gratitude towards Mr. Hess and appreciation of this contribution to vertebrate paleontology.

In New York preliminary sorting of the peccary bones was done mostly by William A. Eames. All the measurements of *Platygonus* and most of the statistical calculations were made by Nathan Altshuler. Mr. Altshuler also drew the text figures for this paper, except figure 1 which is by Marie Bohrn, and assisted in other ways. Mr. Whitaker's assistance, in the laboratory as well as in the field, is also gratefully acknowledged.

LOCATION AND GENERAL DESCRIPTION

The fossil deposit occurs in Cherokee Cave (formerly the Lemp Brewery Cave) in the southeastern part of St. Louis, about six blocks from the river front and in a limestone ridge that rises above the river level. The present entrance to the cave is an artificial shaft on the north side of Cherokee Street between 13th and 18th Streets. (It is here one block from 13th to 18th.) From this point the accessible part of the cave extends eastward and northward under the former De Menil property (now owned by Mr. Hess), east of 18th Street and north of Cherokee Street. The bones were collected from the part of the cave beneath this property.

The cave was almost completely filled with clay when first discovered, but parts of it were excavated during the nineteenth century to provide constant temperature storage for beer, and the cave was connected underground with the Lemp Brewery buildings, on the south side of Cherokee Street, now occupied by the International Shoe Company. After the cave ceased to be used as a beer lager, it was used for a time for recreation, and a small underground theater was installed in one of the former storage rooms. I have elsewhere (Simpson, 1946) published a popular account in which some other details of the cave's history and of our work there are given.

The accessible part of the cave consists of two long, connected channels, one running nearly east-west and the other, with a small offset, nearly north-south, probably representing underground water channels oriented by a joint system in the limestone. The dimensions and general layout are given in the accompanying map (fig. 1), which was not surveyed but is drafted from my field sketches, a sufficient approximation for present purposes. The northward extension of the north-south channel, beyond the offset, had been walled off by the brewery, and the clay in it had not been removed. Mr. Hess broke through this wall and drove an exploratory tunnel through the clay filling. It was here that the bones were found, most of them being from the sides of the recently excavated passage between its beginning (near point A of fig. 1) and the wider cross connection with a water channel shown on figure 1. (Since this map was sketched Mr. Hess' clearing of the cave has been carried much farther.) Incidentally, the bone-bearing clay undoubtedly extended also into the rooms excavated for the brewery and hundreds or probably thousands of bones must have been hauled out by its early workmen. If they noticed the

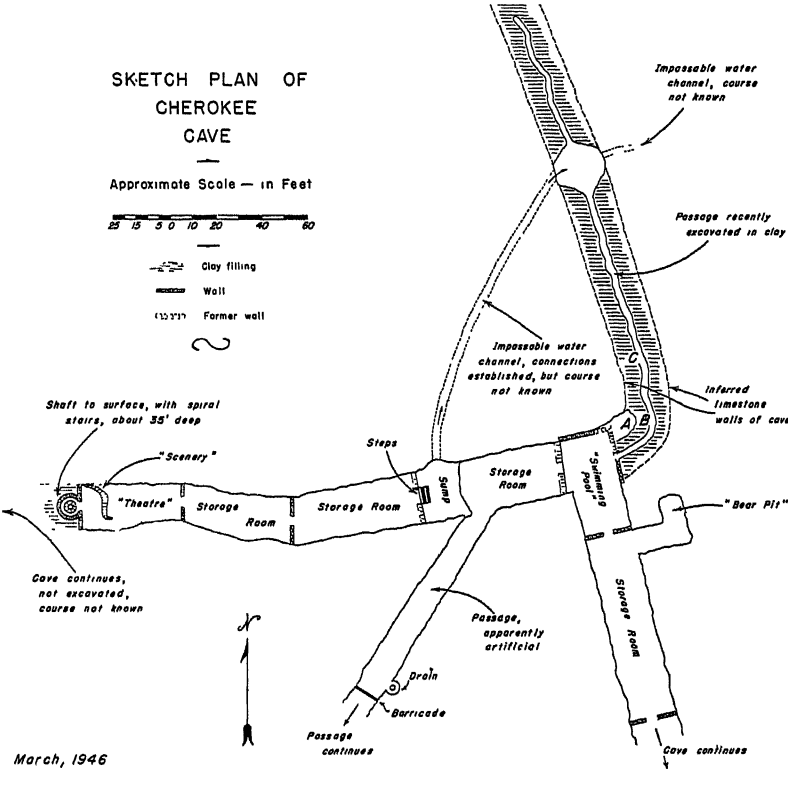
SKETCH PLAN OF
CHEROKEE
CAVE
Approximate Scale — in Feet
25 15 5 0 10 20 40 60
Clay filling
Wall
Former wall
Impassable water channel, course not known
Passage recently excavated in clay
Impassable water channel, connections established, but course not known
C
A
B
Inferred limestone walls of cav
Shaft to surface, with spiral stairs, about 35' deep
"Scenery"
Steps
"Theatre"
Storage Room
Storage Room
Sump
Storage Room
"Swimming Pool"
"Bear Pit"
Cave continues, not excavated, course not known
Passage, apparently artificial
Storage Room
Drain
Barricade
Passage continues
Cave continues
March, 1946

FIG. 1. Sketch plan of Cherokee Cave, St. Louis, showing extent of excavation of newly opened passage in March, 1946. A, B, and C are the locations of sections shown in figures 2–4.

bones at all, no record has survived and no bones were saved as far as known.

The floor of the excavated parts of the cave is still on the clay filling, and the limestone floor, which is probably far below the ground-water level, has not been seen or located. In places a foot or two of air space was present above the clay before excavation, but much of the cave was filled to the ceiling.

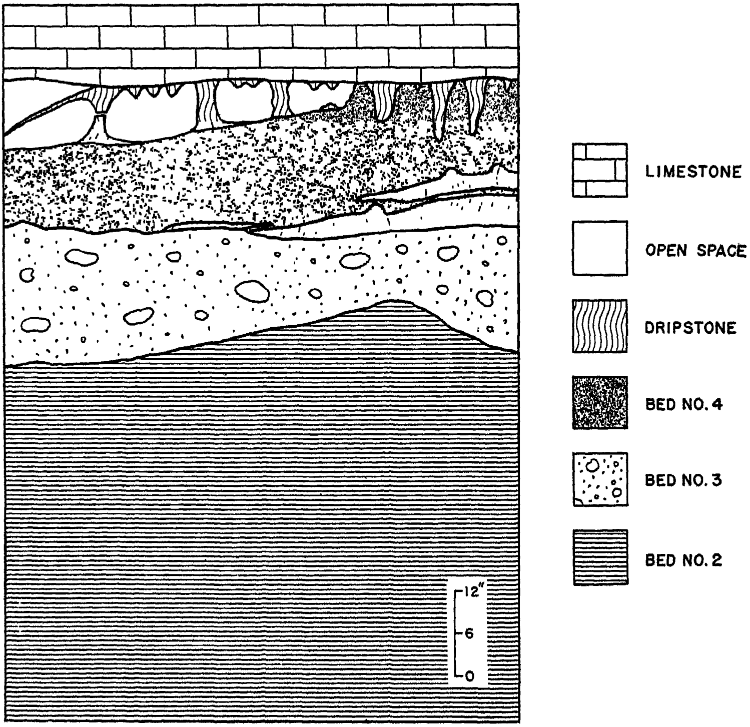

FIG. 2. Diagrammatic section of cave filling at point A of figure 1. The bottom of the diagram is the floor of the excavation, and the clay filling continues below this point. See the text for explanation of designations of the beds.

STRATIGRAPHY

In the part of the cave filling examined by us, four distinct strata can be distinguished, separated by clear-cut disconformities, in addition to dripstone deposits of various ages. The accompanying diagrammatic sections (figs. 2–4) show the relationships of these four strata, the dripstone, and the limestone cave ceiling at points A, B, and C of the map (fig. 1). Conditions farther north along the newly opened passage were variable but similar to those at point C and add nothing of importance for interpretation of the deposits.

For convenience in description the four strata may be distinguished by numbers, starting with the oldest and lowest as No. 1.

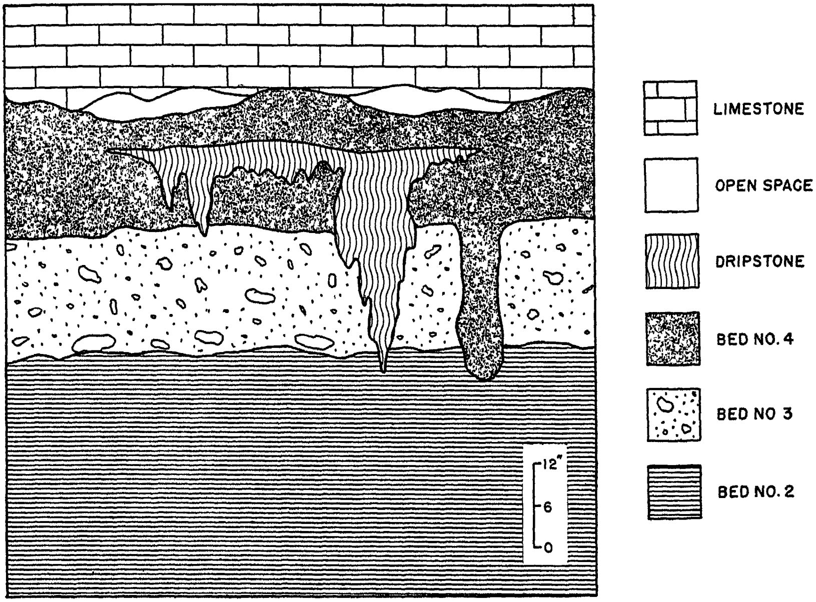

FIG. 3. Diagrammatic section of cave filling at point B of figure 1. The bottom of the diagram is the floor of the excavation, and the clay filling continues below this point. See the text for explanation of designations of beds.

The bottom of bed No. 1 was nowhere seen. The bed is a massive, slightly gritty, yellowish gray clay, without lamination or other visible structure. No bones were found in it. Its top is uneven. At points A and B it has sunk below the approximately horizontal floor of the passage, but northward of B it rises as much as 3 feet above that floor. The surface is also irregular in detail. When the cave was being filled, this surface apparently formed the floor of the cave for some time while deposition ceased. It is commonly covered with a layer of dripstone, 0–5 inches in thickness, from which rise occasional stalagmites, which were buried by later deposits.

Number 2 is a very fine-grained, unctuous, yellow clay which is thinly laminated or varved. It contains some irregular limey concretions and an occasional thin dripstone layer, but no bones or coarse rock fragments were seen in it. It does, however, contain an occasional small lens of fine gravel. It tends to fill in hollows on the surface of No. 1 and reaches a thickness of at least 5 feet at point A (bottom not seen), where the top of No. 1 is below the present floor. Northward, where the top of No. 1 is higher, No. 2 thins out and disappears altogether in places. The top of No. 2 is irregular and was eroded before or during the deposition of No. 3, but no dripstone was seen on this contact, and there is no evidence that it preserves the surface of what was the cave floor for any considerable period.

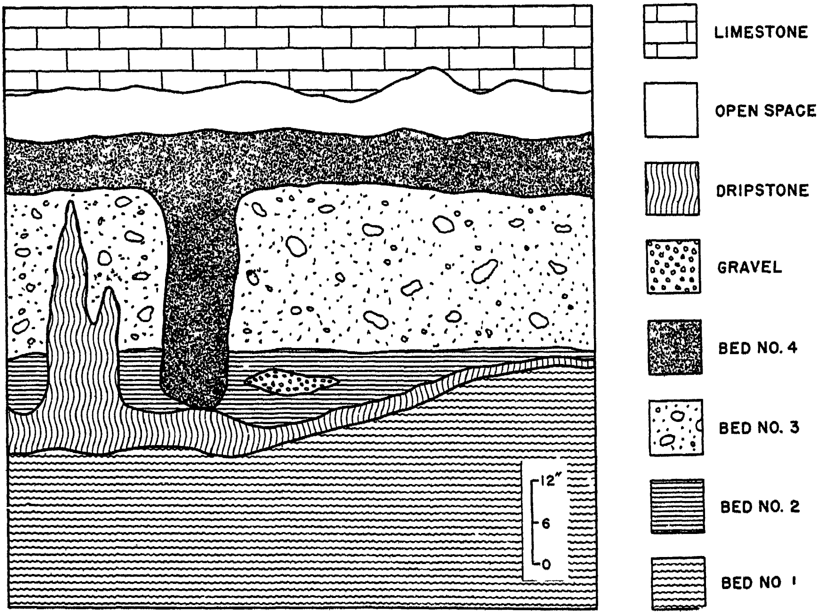

Fig. 4. Diagrammatic section of cave filling at point C of figure 1. The bottom of the diagram is the floor of the excavation, and the clay filling continues below this point. See the text for explanation of designations of beds.

Number 3 is the main fossil-bearing stratum. All the *Platygonus* bones were in this bed. It pinches out locally near the walls, but it is present along the center of the channel, at least, throughout the length of the excavation accessible at the time of our work.

In places it reaches a thickness of several feet, but the average thickness is about 20 inches through most of the region examined by us. The bed as a whole is composed of sticky, plastic, brigh yellow clay without lamination or apparent internal stratification. It contains many fragments of leached limestone, broken pieces of stalactites, stalagmites, and flat dripstone, and concretions apparently secondarily deposited and derived from bed No. 2. Some of the limestone and dripstone fragments are as much as a foot in diameter, although most are smaller. They are angular, without any apparent water wear, and they occur without evident orientation throughout the clay mass.

Bones are scattered throughout this bed, although probably somewhat more common towards the bottom of it. There seems to be some tendency for long bones to lie nearly horizontally, but this is not general, and some are even vertical in the bed. The skeletons are completely disarticulated. No two bones were found in association, and there was no clear tendency for bones of an individual to occur in the same area. In a few cases broken pieces of the same bone were near each other, and the separate rami of an individual porcupine were found within a few feet of each other. Small, compact bones, such as phalanges, carpals, or tarsals, are usually unbroken, but a large percentage of the longer and more fragile bones were broken when found. The epiphyses of young bones have almost always been separated and dissociated. Very young skulls are all disarticulated, but young adult to old skulls have in some cases held together, generally with some breakage.

The top of bed No. 3 is fairly constant in level, but irregular and undulating in detail. It formed the cave floor for some time and is covered with dripstone in places, but this is local and thin. There was some erosion of this surface in places before the deposition of No. 4, and there are occasional thin lenses of laminated clay between No. 3 and No. 4.

Bed No. 4 is composed of loose, granular clay or earth, which looks as if it had been extensively worked since deposition and which contains much pore space and is not compacted. It everywhere overlies No. 3 but is highly variable in thickness, from a mere film up to about 20 inches. It sometimes fills the top of the cave right to the ceiling, but often leaves a small air space at the top. It also fills a number of burrow-like pipes or cavities that extend down into the lower beds (see figs. 3 and 4). There are no *Platygonus* bones in bed No. 4, but it contains some bones of more recent aspect, those of pocket gophers being most numerous. There are also some local concentrations of broken snail shells.

ORIGIN OF THE DEPOSITS

The cave was originally formed by solution localized along fissures, and its form suggests that it provided open, underground, run-off channels while its upper part, at least, was well above ground-water level. Rise in that level or the damming of an outlet or both then caused clay and dirt, washed into the cave, to accumulate there as the No. 1 bed (and any others that may lie below this). Appreciable drainage into the cave then ceased for a time—probably a long time in years, since dripstone up to 5 inches or more in thickness accumulated then. Standing water later formed small pools or lakes in the depressions of the floor and in these there was slow deposition of varved clays, bed No. 2. This evidently represents a wetter time than the post-No. 1 dripstone, but without appreciable drainage through this part of the cave.

The characters of bed No. 3 and of its included rock fragments and bones strongly suggest that it was deposited by running water, torrentially and probably in one short episode. Somewhere a single, large flood of water broke into the cave and washed rapidly through it, spreading along its length a mass of clay along with broken bits of dripstone and of projections from the limestone country rock torn off in the flood. The bones of many peccaries, certainly dozens of them and perhaps hundreds, along with those of a few other animals, came in with the flood and were spread out in the sedimentary mass. It seems highly probable that these remains had not previously been in this part, at least, of the cave and that they were tumbled along in the depositing torrent.

Thus far the interpretation, without being certain, does seem reasonably to follow from the stratigraphic evidence. The still more interesting problem of how the bones were accumulated in the first place and how they came to be washed into the cave (or into this part of it) cannot be surely solved and discussion becomes speculative. It is possible, at least, that the bones were originally in a fissure, where the animals were trapped. Such accumulation of remains of Pleistocene animals, including *Platygonus*, are known at various places in limestone regions. The clay and bone contents of the fissure may then have been suddenly washed or flushed into the cave. The mechanics of this event are still more speculative, but one possibility is that the fissure clay sealed an earlier natural passage from the fissure into the cave, that standing water accumulated above the seal, and that the pressure of this water plus solution in the limestone suddenly broke the seal and let the water drain torrentially into the cave, carrying the fissure filling with it. Even if this speculation is correct, the chances of locating the original fissure and checking the hypothesis are extremely slight, because almost the whole surrounding region has been built up or paved.

After deposition of bed No. 3, whether or not it occurred as postulated, there was another quiescent period in the cave. The floor, now on top of bed No. 3 and in most places within about 2 feet of the ceiling, was only moderately irregular and held only scattered puddles rather than pools as did the floor at the top of bed No. 1. Some dripstone accumulated, but it was thin and localized and apparently dripping was not widespread in the cave. Finally another thin layer of dirt was washed in and covered this floor, filling the cave nearly, in places quite, to the ceiling. The extraordinary thing about the present condition of this layer is that it all seems to have been reworked and aërated and that what can hardly be interpreted as anything but burrows were driven down from it into the underlying deposits.

The probable agent of this activity is represented by remains in bed No. 4: *Geomys bursarius*, the pocket gopher that still lives around St. Louis. It is highly improbable that pocket gophers colonized the cave, even though the evidence of extensive work by them there seems inescapable and even though a practicable nearby entrance, now lost, may have existed. There cannot have been suitable food for the gophers in the cave, and it certainly is not likely that they would voluntarily have worked so extensively at any great distance from a food supply. A possibility is that gophers were repeatedly trapped in the cave and that each worked energetically, instinctively seeking food in the cave earth, before it starved to death

FAUNAL LISTS, CORRELATION

The following forms, further data on which are given in the succeeding section of this paper, occur in the compact, older, bone-bearing bed, No. 3 of the preceding discussion:

Dasypus bellus, extinct armadillo
Marmota monax hessi, extinct (subspecies of) woodchuck
Castor canadensis, American beaver

Erethizon dorsatum, Canada porcupine
Canis sp., large wolf (possibly an extinct form)
Ursus americanus, black bear
Procyon lotor, raccoon
Platygonus compressus, extinct peccary
(A few scraps of undetermined chelonians also occur.)

Of the seven species positively identified, two are extinct and are characteristic of the Pleistocene, although they may also be postglacial in some occurrences. Five species have lived in this general region into historic times. All of these are known from the Pleistocene as well as the Recent. One is represented by an extinct subspecies (or temporal race), and some of the others might also prove to be slightly different from the living subspecies of the region if more reliable comparisons could be made.

In itself the fauna is not conclusive as to age, but it suggests late Pleistocene or early Recent. The presence of *Dasypus*, its most northern known occurrence, may indicate a climate somewhat warmer than at present, but the difference need not have been great and the other forms present are not particularly suggestive of a very warm climate. There is at least some probability that the fauna was interglacial (in that case perhaps the last interglacial epoch) or postglacial (in that case clearly very early postglacial). In faunal type it is what is usually denominated a late Pleistocene fauna, although it is now known that such faunas also occurred in times post-Pleistocene by some other standards.

The presence of a well-marked disconformity and of dripstone above the bed containing these remains is consistent with antiquity, from the point of view of the Recent, but does not necessarily place the bed in frankly Pleistocene time. The episodes of deposition in the cave might conceivably lend themselves to more precise physiographic dating by tying in with regional study of Pleistocene and Recent climate and events, but I am unable to suggest such correlation at present. The paleontological value of precise stratigraphic dating would be limited by the fact that this is not the original site of accumulation of the bones and that the latter may be appreciably older than the bed in which they occur.

The more superficial, loose earth deposit (bed No. 4) above the (nominally) Pleistocene fossil deposit (No. 3) contains the following forms, which are not discussed in the later pages of this paper:

Blarina brevicauda, short-tailed shrew; one mandibular ramus in our collection (A.M.N.H. No. 45745)

Procyon lotor, raccoon; one mandibular ramus (A.M.N.H. No. 45737)

Tamias striatus, chipmunk; two mandibular rami and a premaxillary (A M. N.H. No. 45744)

Geomys bursarius, pocket gopher; parts of two skulls, five mandibular rami, odd teeth, partial skeletons, etc. (A.M.N.H. No. 45743)

There are also numerous fragmentary skeletal elements which seem, for the most part, to belong to the forms listed above on the basis of jaws. There are also some chelonian bones, and fragmentary snail shells, not identified, are locally abundant. The mammals listed above are all Recent species of this region and show no evident differences from forms presumably common at this site before it was overgrown by the city. We also found at this level one mandibular ramus (A.M.N.H. No. 45739) indistinguishable from *Marmota monax hessi*, but its preservation is somewhat different and it was probably derived from the underlying clay. With this exception the fauna is consistent with fully Recent age. The development of dripstone above the layer suggests some historical, but not necessarily geological, antiquity. It is, in any event, definitely younger than the *Playtgonus*-bearing bed and evidently belongs geologically to the Recent epoch.

DESCRIPTIONS OF FOSSILS FROM BED NUMBER 3

ORDER **EDENTATA** CUVIER, 1798

FAMILY **DASYPODIDAE** BONAPARTE, 1838

DASYPUS LINNAEUS, 1758

Dasypus bellus (Simpson, 1929)

Tatu bellus SIMPSON, 1929, p. 579.

This species is represented by six movable band scutes, complete or nearly so, two fragments of similar scutes, a complete caudal scute, and a well-preserved astragalus, all grouped under A.M.N.H. No. 45746. These remains represent a very large *Dasypus*, and are not essentially different from the type and original hypodigm of "*Tatu*" *bellus*[1] from the Pleistocene of Florida. The scutes seem to run slightly larger than the average for the Florida material. The astragalus, on the other hand, is slightly smaller and more lightly built than the one astragalus known from Florida. (The legend of Simpson, 1929, fig. 8, is incorrect; the Florida astragalus is there shown $^2/_3$, not $^4/_3$, natural size.)

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[1] The change from *Tatu* to *Dasypus* is nomenclatural only. When I wrote in 1929 it was believed that the correct name for the peba or nine-banded armadillos was *Tatu*, but the type of *Dasypus* is now fixed as belonging in that group and *Dasypus* is a prior name.

As far as I know, this is the most northern known record for an armadillo, recent or fossil.

ORDER **RODENTIA** BOWDICH, 1821

FAMILY **SCIURIDAE** GRAY, 1821

MARMOTA BLUMENBACH, 1779

Marmota monax (Linnaeus, 1758)

Marmota monax hessi,[1] new subspecies

TYPE: A.M.N.H. No. 45738, nearly complete skull, without teeth except base of right incisor.

HYPODIGM: Type and A.M.N.H. No. 45740, two mandibular rami without cheek teeth

HORIZON AND LOCALITY: Pleistocene, doubtfully sub-Recent, Cherokee Cave, St Louis, Missouri.

DIAGNOSIS: A *Marmota monax* with skull and jaws near the upper limit for that species in all dimensions and above the recorded size of recent specimens in postpalatal length, zygomatic breadth, and length P^4_4-M^3_3. As large as a robust *M. caligata*, but not a member of that specific group. Strong, high, long, single sagittal crest present in the type. Tooth rows divergent anteriorly. Zygomata unusually broad and heavy.

From its size this might be taken for a hoary marmot rather than a woodchuck, an identification that would have considerable interest in view of the locality. There is, however, no doubt that it belongs in the *M. monax* and not the *M. caligata* group. The *M. flaviventris* group does not come into serious consideration. The interorbital region is broad and the postorbital processes are at right angles to the long axis of the skull, not inclined posteriorly. The nasals are wider than the premaxillaries posteriorly. The basioccipital is marked by low ridges converging towards the foramen magnum. The palate is abruptly truncated posteriorly. The interpterygoid fossa is wide. The palatal foramina are narrow anteriorly. These are diagnostic characters of *M. monax* as given by Howell (1915) and confirmed on a large American Museum series of that species. A character not given by Howell and variable and intergrading in the species groups but still suggestive is

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[1] For Mr. Lee Hess, in recognition of his discovery of this faunule and his assistance in its collection.

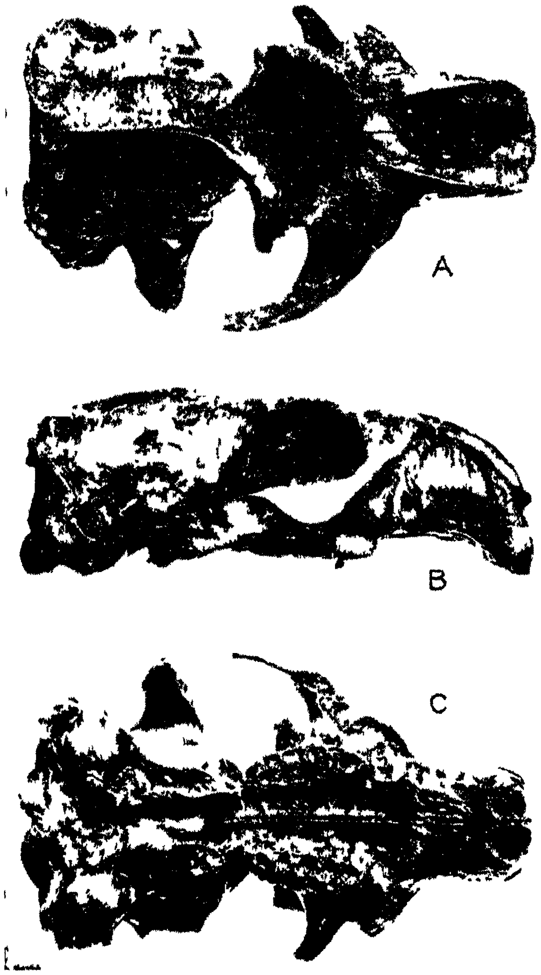

FIG. 5 *Marmota monax hessi*, new subspecies. Type, A.M.N.H. No. 15738, skull. A. Dorsal view. B Right lateral view. C. Palatal view. Two-thirds natural size.

that in *M. monax* the nasals usually project posteriorly into the frontals and have straight, parallel, anteroposterior sutures against the latter. This character also is shared by the fossil.

The only determinable characters of the fossil not in accord with Howell's definition of *M. monax* are the strong development of the sagittal crest and the (moderate) divergence of the tooth rows anteriorly. *M. monax* does frequently develop a sagittal crest, although I have not seen a specimen with this quite as strong as in the fossil. This is, in any case, to a large extent a function of age and size of skull. An old *M. monax* as large as *M. caligata* might be expected to have as strong a crest as the latter, and such is the condition of the fossil. Tooth rows as divergent as in our fossil do sometimes occur in *M. monax* as an individual or perhaps local population character.

The fossil thus clearly belongs near *M. monax* and probably should be placed in that species. It is, nevertheless, outside the observed range of recent *M. monax* as given by Howell (1915) from large series of specimens or as seen in series in the American Museum. Although the recent samples are too heterogeneous in origin and the fossil sample is too small for statistical comparison, there is little doubt that a valid difference exists on a subspecific level at least. The existence of a robust Pleistocene subspecies or temporal race of a Recent species is a common phenomenon. Table 1 gives some comparisons with Howell's figures for *M. monax monax*, which is the largest Recent subspecies and the one that now occurs in this region. Our largest specimen of this subspecies is within the ranges given by Howell.

TABLE 1

SKULL MEASUREMENTS IN MILLIMETERS OF *Marmota monax hessi* AND *M. m. monax*

	Type, *M. monax hessi*	*M. monax monax* after Howell (N = 10)
Condylobasal length	102.1	90.4–102.5
Palatal length	60.2	53.4–59.5
Postpalatal length	39.7	32.6–37.8
Zygomatic breadth	*ca.* 72	59.5–67.3
Breadth across mastoids	*ca.* 49	42.9–50.2
Least interorbital breadth	29.3	23.5–29
Breadth of rostrum	23.4	19.5–23.7
Maxillary tooth row (alveoli)	23.5	20.5–21.9

As far as I know, the only Pleistocene American possible member of the *M. monax* group to which a distinctive name has previously been applied is "*Stereodectes tortus*" Cope, 1869. This was based on an upper incisor, which is not well identifiable and may represent a Recent form. The name is, in any case, essentially a *nomen vanum*, and comparison with *M. monax hessi* would be neither necessary nor profitable.

There is, unfortunately, some question as to the exact level in the cave of the type skull of this subspecies. It was found by workmen after we left St. Louis, and its color is dark brown, unlike the cream or yellow with black stains usual for bones in bed No. 3. There is, however, one *Platygonus* jaw closely similar in color and preservation, and the bones from the top layer, No. 4, are not brown. We also found certainly in bed No. 3 right and left mandibular rami (A.M.N.H. No. 45740) of an unusually robust *Marmota*, with tooth series longer than in Recent *M. monax* and of the right size to occlude with the skull of *M. monax hessi*, to which subspecies these mandibles of known horizon may be referred. A closely similar, equally robust ramus (A.M.N.H. No. 45739) was also found in bed No. 4, above the clay with *Platygonus*. Its preservation is more like that of the bones in the older clay than like the other bones found at this upper level, which look distinctly more recent. It is thus probable that this robust *Marmota* jaw was actually derived from the top of the *Platygonus*-bearing clay and reworked into the younger deposit.

FAMILY **CASTORIDAE** GRAY, 1821

CASTOR LINNAEUS, 1758

Castor canadensis Kuhl, 1820

A beaver, within the range of the common living species, is represented by a left lower jaw with the incisor and M_{1-3} (A.M.N.H. No. 45741), and by a few other fragments.

FAMILY **ERETHIZONTIDAE** THOMAS, 1897

ERETHIZON CUVIER, 1822

Erethizon dorsatum (Linnaeus, 1758)

Right and left mandibular rami, with left P_4–M_3 and right M_{2-3} (A.M.N.H. No. 45742), were found separately but apparently belonged to a single individual. They are somewhat above average size for the Recent Canada porcupine but are within its range in all respects.

ORDER **CARNIVORA** BOWDICH, 1821

FAMILY **CANIDAE** GRAY, 1821

CANIS LINNAEUS, 1758

A very large wolf is represented by numerous foot bones, especially eight complete metapodials, and other fragments, but no teeth. At least two individuals are represented. Adequate series of foot bones of recent wolves have not been available for comparison, but two specimens of the large, so-called *Canis occiden-*

TABLE 2

Measurements in Millimeters of Metapodials in Pleistocene Wolf from St. Louis and a Large Recent Timber Wolf

	Pleistocene A.M.N.H. No. 45732		Recent A M.N.H. No. 98230
MC[a] II			
L[b]	98.5		93
W[c]	12.1		10.0
W/L	.12		.11
MC IV			
L	101.4		104
W	10.8		9.9
W/L	.11		.11
MC V			
L	99.5	94 6	101
W	14.5	13.6	10.9
W/L	.15	.14	11
MT[d] II			
L	111.9	103 9	101
W	13 0	12.3	10.0
W/L	.11	12	10
MT IV			
L	126.6		115
W	12 5		10.0
W/L	.10		.09
MT V			
L	101.6		106
W	12.9		9.3
W/L	.13		09

[a] MC, metacarpal.

[b] L, maximum length, which is approximate only for the recent species, the bones of which are articulated.

[c] W, maximum diameter at the middle of the shaft.

[d] MT, metatarsal

talis[1] have most of the metapodials and phalanges shorter and more slender than this fossil form. Published data on foot bones of the Pleistocene wolves are also inadequate for sufficient comparison or exact identification of these fossils, but the foot bones of our two skeletons of *Canis dirus* from Rancho La Brea, as well as those described in the literature on that form, are decidedly smaller than the St. Louis fossils.

I have been unable to find any record of a wolf with feet quite as heavy as these fossils, but very little attention has been paid to foot bones in this group and it remains possible that some form known from teeth or from small variants did have feet that reach this size. As shown in table 2, an exceptionally robust recent specimen does have the fourth and fifth metacarpals and the fifth metatarsal slightly longer than in the fossils and the fourth metacarpal is about as stout, although the other three compared metapodials are shorter than in the fossil and all but one of the six compared are more slender. Possible differences of proportions suggested by the inconsistencies cannot be emphasized strongly because the fossil bones are not individually associated. The comparison shows that the fossils could belong to remarkably robust representatives of the Recent group. There is, nevertheless, a distinct possibility that they represent a large extinct form.

FAMILY **URSIDAE** GRAY, 1826

URSUS LINNAEUS, 1758

Ursus americanus Pallas, 1780

The collection includes part of a right mandibular ramus with M_3 and alveoli for the other cheek teeth and the canine (A.M.N.H. No. 45729), a loose M_3 of a different individual (A.M.N.H. No. 45730), and a loose lower canine (A.M.N.H. No. 45731), all of which are referred tentatively to *Ursus americanus*. The lower jaw has only a flattened or slightly concave area in place of the distinct anterior masseteric fossa of *Tremarctos* or the extinct arctotheres, and it is more slender than in any adult *Ursus horribilis* in our collection. It can be closely matched among recent specimens of *U. americanus*. M_3 and (as seen by their alveoli) the other cheek teeth are, however, considerably larger than is usual in *U. americanus.* M_3 of this lower jaw measures 16.7 mm. in length and 12.3 mm. in width. The loose M_3 is larger still: 19.6 by 14.6 mm.

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[1] In a modern, genetically valid taxonomic system this group would probably become a subspecies, perhaps of *Canis mexicanus*, as has been suggested by Anthony, or perhaps of a pan-Holarctic species *Canis lupus*

At first sight it seems improbable that these two teeth could belong to the same species or that either one could belong to the living species of black bears. There are, however, Recent black bears in our collection that have M_3 as large as the larger of the fossil teeth, although most of them have M_3 smaller than the smaller fossil. These very large Recent black bears also have exceptionally heavy jaws, heavier than the fossil jaw, and the latter cannot be precisely matched in our Recent series. *U. americanus* is extraordinarily variable in depth of jaw and size (also shape) of M_3, and the several characters of the fossils are, separately, within the demonstrated range for the Recent animals. Their being near the apparent limits of that range for size of M_3 and the unusual combination of robust teeth and slender jaw might indicate a distinction around the subspecific level, but there is no firm basis for this at present.

By reasonable and modern criteria for species as genetically intergrading populations, there are only three living species of bears in North America: *Ursus americanus*, the black bears and their various phases of other colors; *Ursus horribilis*, the grizzly bears and the big northern brown bears; and *Ursus maritimus*, the polar bear. The first two of these species apparently show considerable differentiation at or below the subspecific level, but the true nature of this differentiation and the ranges of subspecies really definable in terms of populations rather than of individual variations are not at present established. It is not likely that the many "species" recognized by Merriam correspond with recognizable subspecies or make any real contribution to an understanding of these groups. Pending a more realistic restudy of these problems, there is no good way of evaluating apparent peculiarities of fossil black bears, and the present specimens can only be recorded as belonging somewhere in a general *U. americanus* Pleistocene-Recent complex.

FAMILY **PROCYONIDAE** BONAPARTE, 1850

PROCYON STORR, 1780

Procyon lotor (Linnaeus, 1758)

Partial upper and lower jaws (one of each; A.M.N.H. Nos. 45736 and 45735) from bed No. 3 are within the range of variation of this modern species. There is also a nearly complete skull (A.M.N.H. No. 45733), of unknown level but probably from bed No. 3, which likewise represents a robust raccoon, within the range of *Procyon lotor* and confidently referred to that species. It is above the average size of the Recent specimens used for comparison, but Recent raccoons do reach its size and it is in any event common for Pleistocene populations to average slightly larger than Recent populations of the same species. The basal length of this skull is 105 $^1/_2$ mm.

This species also occurs in the superficial bed (No. 4) above the *Platygonus*-bearing clay (No. 3) as noted above, and we also have a lower jaw of unknown level (A.M.N.H. No. 45734) found by workmen before our visit to the cave.

ORDER **ARTIODACTYLA** OWEN, 1848

FAMILY **TAYASSUIDAE** PALMER, 1897

PLATYGONUS LECONTE, 1848

Platigonus LECONTE, 1848a, p. 103; PETERSON, 1914, p. 114. [Original spelling evidently a misprint, although adopted by Peterson.]

Platygonus LECONTE, 1848b, p. 258; and almost all later authors, see standard bibliographies.

Hyops LECONTE, 1848a, p. 104; = *Platygonus*, Leidy, 1857, p. 100.

Euchoerus LEIDY, 1853, p. 340; = *Platygonus*, Leidy, 1857, p. 100.

Coyametla DUGÈS, 1887, p. 16. [First published as an acknowledged synonym of *Platygonus*.]

The bulk of the present collection belongs to this genus and to its commonest species, *P. compressus*. The genus and species are so well known and have already been discussed so voluminously in print that extended descriptions would be superfluous. The opportunity is taken, however, to present some new data on variation and to summarize some other points of interest on which new light is thrown by this collection.

Platygonus is a characteristic member of the various Blancan faunas. (See Colbert, 1938; Cope, 1893; Gazin, 1938; Gidley, 1903; Hibbard, 1937, 1941; J. R. Schultz, 1937.) Reports of the genus from pre-Blancan horizons are dubious or probably incorrect. The Blancan species seem to be distinct from those of later ages, but they are still inadequately understood. The genus also occurs in South America from the Chapadmalalan to the sub-Recent (Rusconi, 1930). This is one of the items of evidence that place the Chapadmalalan as Blancan, at earliest, in age.[1] The various South American species are mostly based on inadequate materials and of doubtful status, although *P. carlesi* Rusconi, 1930, is based on a good skull.

In post-Blancan, frankly Pleistocene beds in North America *Platygonus* is a rather common fossil and evidently ranged over the whole of what is now the United States and also in Mexico. Although it may be quite absent or rare in some otherwise rich Pleistocene faunules, when it does occur in a faunule, it is likely to be abundant or even to constitute the bulk of the material, as it does in the faunule here described. This suggests the probability that the animals, like their living relatives, favored widespread or recurrent but more or less local ecological conditions and were gregarious. Aside from burial of a few strays, preservation ensued when a whole group of them was overtaken by catastrophe (for example, the group found by Williston in Kansas; see Williston, 1894b) or when a fissure or other trap happened to occur in their favored local range and took repeated toll of the herds (for example, Gidley and Gazin, 1938, and probably the occurrence here discussed).

The great majority of North American Pleistocene *Platygonus* seem to belong to a single, highly variable species, *P. compressus*, some notes on which are given below. There are, however, three other proposed species, all of which seem to be distinct from *P. compressus* but which remain of quite doubtful status and possible synonymy among themselves: *P. vetus* Leidy, 1882, *P. alemanii* Dugès, 1887, and *P. cumberlandensis* Gidley, 1920 (with its synonym *P. intermedius* Gidley, 1920; see Gidley and Gazin, 1938). *P. vetus* was based on upper and lower jaw fragments from Pennsylvania. A few still less perfect specimens have been referred, but the specific characters of the skull and dentition as a whole have never been established. *P. alemanii* was based on a partial palate and lower jaw from Guanajuato, Mexico. Leidy (1889) was inclined to consider this synonymous with *P. vetus*.

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[1] Thus Rusconi, who considered the Chapadmalalan as middle Pliocene but who implied that its peccaries are probably post-Blancan, was forced to list the supposedly ancestral Blancan *P. bicalcaratus* as if it were from the Mio-Pliocene transition (Rusconi, 1930, fig. 30, p. 208). In more recent studies it is universally agreed that the Blancan belongs a whole epoch later, on the Plio-Pleistocene transition. Dispute as to whether to call it latest Pliocene or earliest Pleistocene is purely formal and does not concern its relative position in the sequence, which now cannot even by formal and verbal arguments be considered as early as middle Pliocene.

Most other students have tentatively kept the two separate, but without particular investigation of the possible synonymy. Recently Skinner (1942) has referred to *P. alemanii* four good skulls and some other material from Arizona, but he was unable to make the comparisons that would have tested their pertinence to *P. alemanii* and their distinction from *P. compressus*. *P. cumberlandensis* seems to be distinct from *P. compressus* and from Skinner's referred *P. alemanii*, but possible synonymy with either or both of *P. vetus* and typical *P. alemanii* does not seem wholly excluded by the published comparisons.

There is little question as to the generic synonymy given above, which omits one or two possible synonyms described from South America. *Hyops* and *Euchoerus* date from early discoveries when the genus was poorly known, and their separation was early corrected by Leidy (1857 and subsequently). In 1857 Leidy was inclined to equate both these names and also *Platygonus* with "*Dicotyles*" (= *Tayassu*). He subsequently recognized that *Platygonus* is quite distinct from the living genus (e.g., Leidy, 1869), and this has been abundantly confirmed and accepted by all later authors. Dugès (1887) stated that he had placed the Mexican form in a new genus *Coyametla* until Cope pointed out its pertinence to *Platygonus*. As far as I can find, Dugès had not previously published *Coyametla*, and it appeared only as a stillborn synonym, so acknowledged by its author.

Leidy also considered the genus *Protochoerus* LeConte, 1848, as a synonym of *Platygonus*, and on his authority it has usually been so listed by subsequent students. I have not restudied the very fragmentary type specimens, but from what published data there are, it does not seem certain that the type species, *Protochoerus prismaticus* LeConte, 1848, belongs to *Platygonus*. It may be preferable to ignore possible synonymy with this or some other group of peccaries and to maintain that *Protochoerus* is a *nomen vanum*, that is, a hollow name attached to an unrecognizable genus.

Platygonus compressus LeConte, 1848

Platigonus compressus LECONTE, 1848a, p. 103. ["*Platigonus*" probably a misprint]

Platygonus compressus, LECONTE, 1848b, p. 258; LEIDY, 1853, p. 234, 1857, p. 100, 1869, p 383.

Dicotyles compressus, LEIDY, 1857, p. 100.

Hyops depressifrons LECONTE, 1848a, p. 104, = *Platygonus compressus*, Leidy, 1857, p 100.

Dicotyles depressifrons, LECONTE, 1852a, p. 3; LEIDY, 1853, p. 330; = *Platygonus compressus*, Leidy, 1857, p 100.

Dicotyles costatus LECONTE, 1852b, p. 5; LEIDY, 1853, p. 331; = *Platygonus compressus*, Leidy, 1857, p. 100.

Euchoerus macrops LEIDY, 1853, p. 340; = *Platygonus compressus*, Leidy, 1857, p. 100.

Protochoerus macrops, LEIDY, 1857, p. 100; = *Platygonus compressus*, Leidy, 1857, p. 100.

Platygonus leptorhinus WILLISTON, 1894a, p. 164, 1891b, p. 27; = *Platygonus compressus*, Wagner, 1903, p. 780.

Platigonus leptorhinus, PETERSON, 1914, p. 114.

Platygonus setiger HAY, 1920, p. 84.

Platygonus francisi HAY, 1927, p. 299.

HISTORY AND SYNONYMY

This was one of the earlier American fossil mammals to be found and (approximately) identified, although it was nearly 50 years before the original discovery made its way into print. An excellent skull was obtained in 1804 or early in 1805 by Dr. Samuel Brown of Lexington from a cave in Kentucky. Brown forwarded it in November, 1805, to the American Philosophical Society. At the meeting of January 17, 1806, Dr. Caspar Wistar, who may properly be designated as the first American vertebrate paleontologist, correctly reported to the Society that the skull belonged to a peccary. (See Simpson, 1942.) It was not, however, until 1853 that a description of the skull was published by Leidy. In the meantime LeConte had named *Platygonus compressus* and its synonym *Hyops depressifrons* from much more fragmentary materials found in a fissure near Galena, Illinois, as well as another probable synonym, *Dicotyles costatus*, from still more fragmentary material (an isolated lower canine) from Benton County, Missouri.

In his memoir of 1853, Leidy recognized all of LeConte's species as distinct and placed the Kentucky skull in a new genus and species, *Euchoerus macrops*. He later made a study of variation in peccaries and, reaching an understanding of specific scope better than that of too many of his successors, concluded that his and LeConte's supposed genera and species were all variants of a single species (Leidy, 1857). "*Euchoerus macrops*" was thus reduced to synonymy with *Platygonus compressus*. Ever since 1857 the Kentucky skull has been used as a standard of comparison for the latter species in place of the much less perfect or diagnostic types and has, indeed, become a sort of informal neotype. Leidy

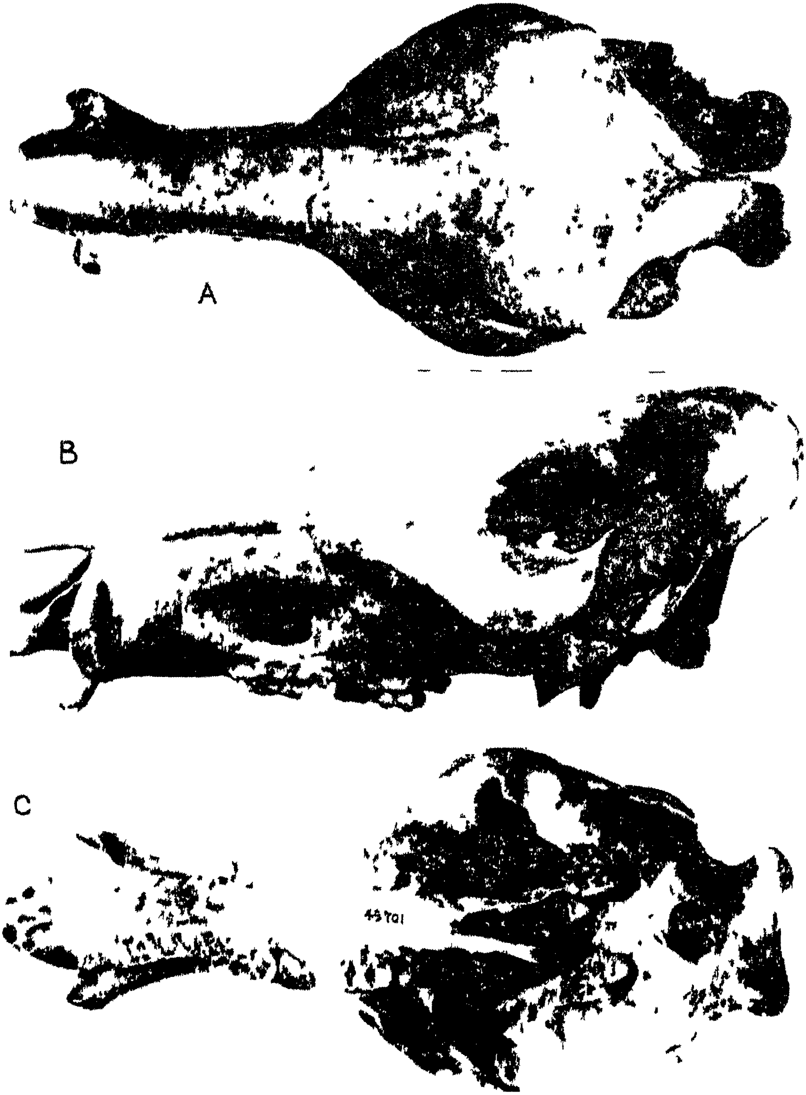

Fig. 6 *Platygonus compressus* A M N H No 45701, old skull from Cherokee Cave, St Louis The tip of the nasals is restored (This specimen has been returned for display in the museum at the cave.) A Dorsal view B Left lateral view C Palatal view One-third natural size

finally (1889) also described and figured another skull (associated with an undescribed skeleton) which was one of a series found near Rochester, New York, and sold by Henry A. Ward.

The most complete knowledge of the genus, and probably also of the species, has, however, been based on nine articulated skeletons found together near Goodland, Kansas, and described especially by Williston (1894b), with additional comments by Peterson (1914) and others. Williston showed that the skulls of these individuals have numerous (but minor) differences of detail from those referred by Leidy to *Platygonus compressus*. Williston confessed his inability to decide whether his specimens represented a different species, but he proposed to call them *Platygonus lepto-*

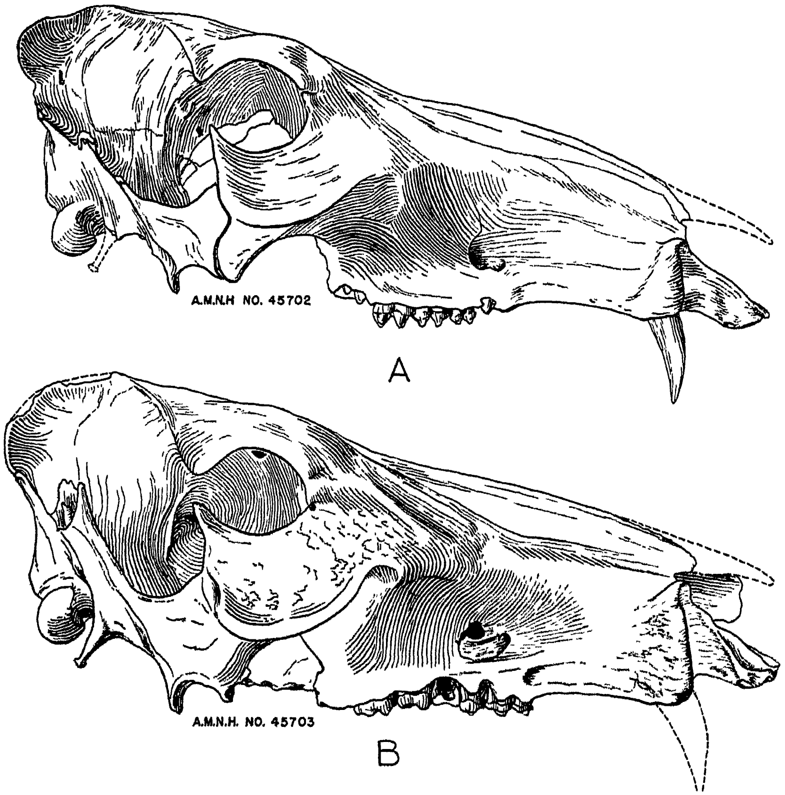

FIG. 7. *Platygonus compressus*. Contrast of age characters in skulls from Cherokee Cave, St. Louis. A. A.M.N.H. No. 45702, young skull. B. A.M. N.H. No. 45703, senile skull. Right lateral views. One-third natural size.

rhinus pending more extended comparison of all known material of the genus. Wagner (1903) considered *P. leptorhinus* a synonym of *P. compressus*, but Peterson (1914) kept them separate, depending still on minor deviation from Leidy's figures of the referred Kentucky skull. The present material, together with the availability of one of Williston's syntypes for direct comparison,

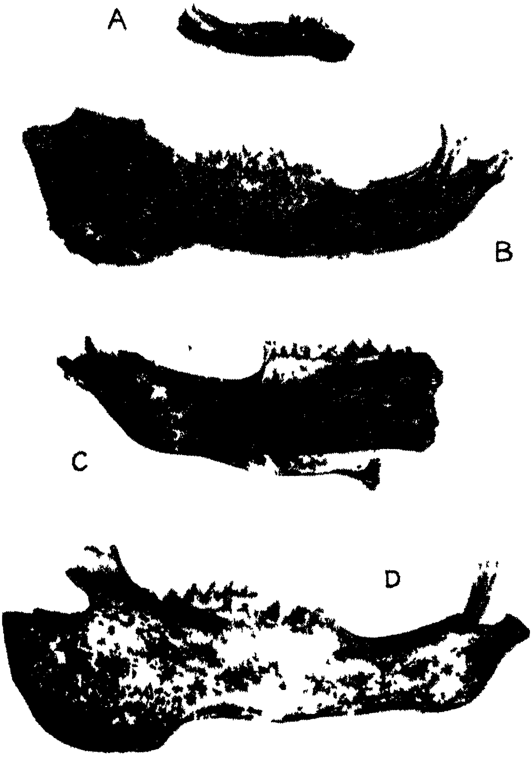

FIG. 8. *Platygonus compressus.* Contrast of age characters in lower jaws from Cherokee Cave, St. Louis. A. A.M.N.H. No. 45747. Left lower jaw, neonate, with dc and dm_4, both unworn, and alveoli for dm_{2-3}. B. A.M.N.H. No. 45722. Right lower jaw. Deciduous and permanent canines both functioning. Dm_{3-4} in place, M_1 erupted but unworn, M_{2-3} not erupted. C. A.M.N.H. No. 45720. Left lower jaw. Deciduous canine recently lost, permanent canine functioning but not fully protruded. Dm_{2-4} all well worn, M_1 beginning to wear, M_2 erupting. D. A.M.N.H. No. 45719. Right lower jaw. Permanent canine well protruded. Deciduous premolars lost, P_{3-4} erupting, M_1 beginning to wear, M_2 erupted but unworn. All lateral views, one-third natural size.

permits further consideration of this point, which is discussed below with the conclusion that *P. leptorhinus* is based on a local population of *P. compressus*.

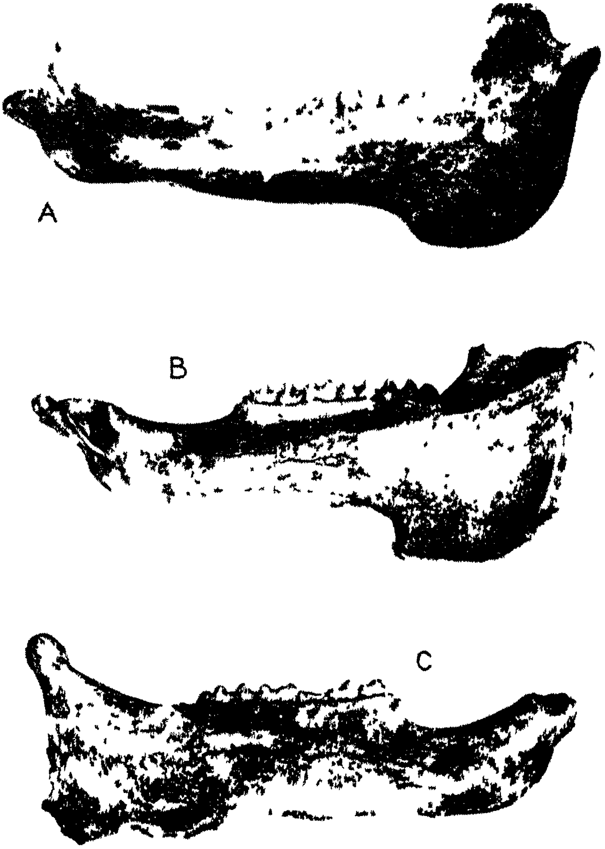

FIG. 9. *Platygonus compressus*. Continuation from figure 8 of age series of lower jaws A. A.M.N.H. No. 45713 Left lower jaw. M_1 slightly worn, M_2 in place but unworn, M_3 erupting. (Nearly same age as A.M.N.H. No. 45719, fig. 8D.) B. A.M.N.H. No. 45724. Left lower jaw. All permanent teeth in place, M_3 slightly worn. Fully adult. C. A.M.N.H. No. 45727. Right lower jaw M_1 worn to roots, M_{2-3} well worn. Senile. All lateral views, one-third natural size

Hay's proposals of two additional species were based on inadequate materials without sufficient comparison of previous specimens or proper consideration of variation in the established species. The type of *P. setiger* is the isolated root of a lower canine. It is slightly larger than any specimen in the St. Louis collection and is not precisely like any of them but could readily be a robust variant of the same species. Such material is not, in fact, specifically characteristic, and it seems justified to get rid of this ill-founded name by placing it in the synonymy of *P. compressus*. *P. francisi* has a somewhat better but still inadequate type, consisting of fragments of a lower jaw with M_{2-3}. The only possibly significant character in Hay's description, measurements, and figures seems to be the keel on the lower surface on the symphysis, which is less sharp in his specimen than is usual in specimens previously referred to *P. compressus*. This character is not known in the

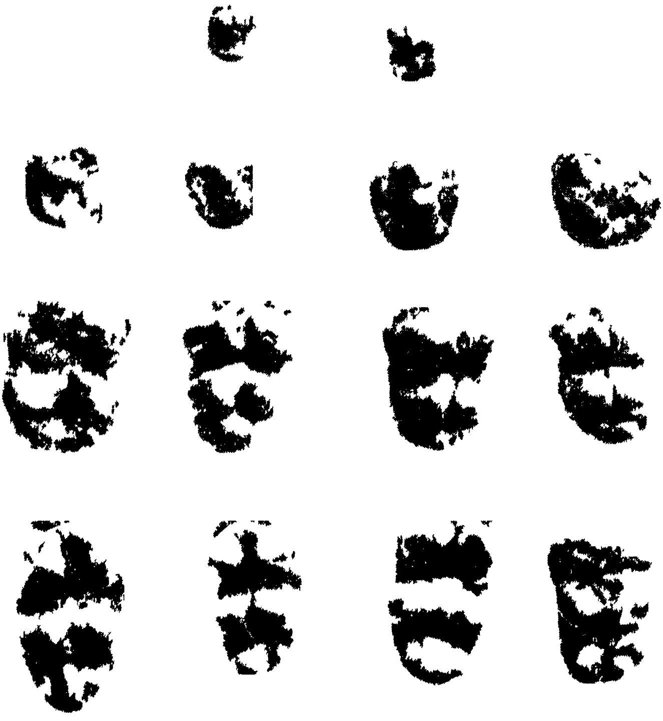

FIG. 10 *Platygonus compressus* Morphological variation in isolated teeth from Cherokee Cave, St Louis Top row, P_2 Second row, two left figures, P^3 Second row, two right figures P^4 Third row, M^3. Bottom row, M_3 All crown views, natural size

actual type of *P. compressus,* and if it were really indicative of specific distinction, then *P. compressus* would become indeterminate. I see, however, no present reason to conclude that this variation does reflect a difference in species, and the simplest solution to the problem is to consider *P. francisi* as another synonym of *P. compressus.*

NOTES ON VARIATION

The collection includes five skulls, many partial palates and jaws, still more numerous isolated teeth, and isolated skeletal bones, particularly metapodials. The conditions of occurrence do not guarantee that all these remains are precisely contemporaneous, but there is no internal evidence that more than one sort of peccary is present, and it is a probable inference that the whole collection is a sample of a single population. A study has been made of variation in the series as a whole, and some data in convenient form are here presented for the parts most likely to be of use in comparative studies: the teeth and the metapodials.

The basic tooth pattern is well fixed and relatively invariable as regards the main cusps and their relationships. There is, however, great variation in size, proportions, and many structural details affecting minor crests, cingula, and heels. One or two of the teeth seem to represent malformations, but even within the apparently normal range such structures as, for instance, the heel of M_3 or M^3 show marked differences in size and in the number and arrangement of cuspules. Extended descriptions are not presented here, but the accompanying figures (fig. 10) give an idea of the extent and nature of morphological variation.

Statistical data on the cheek teeth are given in tables 3–5 and figures 11–13. The following abbreviations are used:

N = number of measurements included
OR = observed range
SR = span of standard range (see Simpson, 1941)
M = mean
σ = standard deviation
V = coefficient of variation
L = maximum length between planes tangential to the ends of the enameled crown and at right angles to the long axis of the tooth series
L_1 = length (as above) measured on teeth in series in the jaw
L_0 = length (as above) measured on isolated teeth
W = maximum width between vertical planes tangential to the sides of the enameled crown and parallel to the long axis of the tooth series,

with the tooth oriented (in the jaw or as if it were) with the tooth series horizontal

W_a = width (as above) across anterior lobe

W_m = width (as above) across median lobe (on dm_4 only)

W_p = width (as above) across posterior lobe (not counting the posterior cingulum or minor third lobe of M^3_3)

TABLE 3

STATISTICAL DATA ON PERMANENT UPPER CHEEK TEETH OF *Platygonus compressus* FROM ST. LOUIS

	N	OR	SR	M	σ	V
P^2						
L	7	9.1–10.7	3.34	9.81 ± .20	.52 ± .14	5.27 ± 1.4
W	7	9.3–10.1	1.76	9.76 ± .10	.27 ± .07	2.78 ± .74
P^3						
L	12	9.5–11.5	3.25	10.43 ± .14	.50 ± .10	4.82 ± .98
W	12	10.4–12.1	2.77	11.49 ± .12	.43 ± .09	3.72 ± .76
P^4						
L	21	9.3–12.7	5.31	10.78 ± .18	.82 ± .13	7.59 ± 1.2
W	21	12.3–14.8	4.30	13.25 ± .14	.66 ± .10	5.01 ± .77
M^1						
L_i	19	12.9–15.2	4.74	14.08 ± .16	.73 ± .12	5.19 ± .84
L_o	10	13.3–15.4	4.94	14.23 ± .24	.76 ± .17	5.35 ± 1.2
W_a	29	11.9–16.0	5.91	13.57 ± .17	.91 ± .12	6.72 ± .88
W_p	29	11.6–15.2	5.85	13.50 ± .17	.90 ± .12	6.69 ± .88
M^2						
L_i	17	14.8–18.2	6.27	16.71 ± .23	.97 ± .17	5.79 ± .99
L_o	17	15.1–19.3	6.40	17.49 ± .24	.99 ± .17	5.65 ± .97
W_a	34	13.8–17.4	5.96	15.59 ± .16	.92 ± .11	5.90 ± .72
W_p	34	13.6–16.5	5.70	15.01 ± .15	.88 ± .11	5.86 ± .71
M^3						
L_i	14	18.2–22.6	9.40	20.26 ± .39	1.45 ± .27	7.15 ± 1.4
L_o	12	19.0–23.6	8.23	21.00 ± .37	1.27 ± .26	6.07 ± 1.2
W_a	26	11.8–17.9	6.02	16.20 ± .18	.93 ± .12	5.73 ± .80
W_p	26	12.0–16.6	6.16	13.70 ± .19	.95 ± .13	6.94 ± .96

Standard errors are given for M, σ, and V. Measurements are all in millimeters.

Measurements of length were kept separate for teeth in series and those isolated when the available teeth were numerous enough in both groups to warrant separate calculation of statistics. In the course of his painstaking measuring, Mr. Altshuler felt that the impossibility of closing the calipers on both ends of a tooth in series must make such measurements inaccurate and probably consistently smaller than length measurements on isolated teeth.

This is a matter of general methodological interest, because paleontologists have commonly compared measurements of isolated teeth and those in series indiscriminately. The present work seemed to present a test case for judging the extent to which this factor may influence such comparisons. The prediction proved to be justified, for the means of lengths as measured on teeth in series are smaller than the means of homologous measurements on isolated teeth in all but one case (for LP_3, where the slight difference is probably due to chance). The consistency of this result makes it probably significant, but for each individual dimension

TABLE 4

STATISTICAL DATA ON PERMANENT LOWER CHEEK TEETH OF *Platygonus compressus* FROM ST. LOUIS

	N	OR	SR	M	σ	V
P_2						
L	7	8.0–10.3	5.02	8.87 ± .29	78 ± .21	8.75 ± 2.3
W_a	7	4.9–7.0	3.90	6.06 ± .23	.60 ± .16	9.93 ± 2.7
W_p	7	5.2–8.6	6.18	6.70 ± .36	.95 ± .25	14.22 ± 3.8
P_3						
L_i	14	9.8–11.3	2.79	10.56 ± .12	43 ± .08	4.08 ± .77
L_o	11	9.7–11.4	3.30	10.63 ± .15	.51 ± .11	4.80 ± 1.0
W_a	25	7.1–8.5	2.72	7.82 ± .08	.42 ± .06	5.37 ± .76
W_p	25	7.8–10.2	3.67	8.59 ± .11	.57 ± .08	6.60 ± .93
P_4						
L_i	15	10.4–12.1	3.38	11.40 ± .13	52 ± .10	4.57 ± .84
L_o	10	11.0–13.8	4.91	12.11 ± .24	.76 ± .17	6.25 ± 1.4
W_a	25	8.7–10.8	3.53	9.36 ± .11	.54 ± .08	5.80 ± .82
W_p	25	8.9–12.2	4.99	9.90 ± .15	.77 ± .11	7.78 ± 1.1
M_1						
L_i	15	13.3–15.0	3.29	14.22 ± .13	.51 ± .09	3.57 ± .65
L_o	4	13.3–15.2	4.78	13.95 ± .37	.74 ± .26	5.28 ± 1.9
W_a	19	8.9–10.3	2.38	9.48 ± .08	.37 ± .06	3.88 ± .63
W_p	19	9.7–11.0	2.33	10.25 ± .08	.36 ± .06	3.52 ± .57
M_2						
L_i	29	13.9–18.2	6.11	16.61 ± .18	.94 ± .12	5.68 ± .75
L_o	13	15.0–19.5	8.16	16.97 ± .35	1.26 ± .25	7.42 ± 1.5
W_a	42	10.2–13.4	4.39	12.06 ± .10	.68 ± .07	5.62 ± .61
W_p	42	10.4–14.4	4.70	12.46 ± .11	.73 ± .08	5.82 ± .63
M_3						
L_i	18	21.5–25.3	5.98	23.36 ± .22	.92 ± .15	3.95 ± .66
L_o	24	21.2–26.5	7.39	23.71 ± .23	1.14 ± .16	4.81 ± .69
W_a	43	12.0–14.6	3.99	13.37 ± .09	.62 ± .07	4.61 ± .50
W_p	43	11.8–14.6	3.97	12.83 ± .09	.61 ± .07	4.78 ± .52

the differences are so slight that they would normally be obscured by random sampling variation. In no case is the difference in means for teeth in and out of series greater than .78 mm. Even in this extreme case, the probability of such a difference appearing purely by chance (estimated by Student's *t* test) in samples of this size from the same population is greater than .02. In all the other instances the probability is greater than .05, and the difference (for each individual tooth) has no statistical significance. In short, length measurements on teeth in series do run slightly lower than on isolated teeth, but the difference is so small that it is unlikely to vitiate any proper comparisons that could reasonably be made with such materials.

TABLE 5

STATISTICAL DATA ON DECIDUOUS CHEEK TEETH OF *Platygonus compressus* FROM ST. LOUIS

	N	OR	SR	M	σ	V
dm$_2$						
L	2	8.1–8.4	—	8.25	—	—
W	2	4.9–5.1	—	5.0	—	—
dm$_3$						
L	4	9.2–10.5	—	9.73	—	—
W	4	6.5–7.4	—	6.80	—	—
dm^2						
L	7	17.0–18.1	2.20	17.51 ± .13	.34 ± .09	1.94 ± .52
W$_a$	7	7.8–8.8	2.29	8.34 ± .13	.35 ± .10	4.24 ± 1.1
W$_m$	7	7.2–8.6	3.08	7.69 ± .18	.48 ± .12	6.19 ± 1.7
W$_p$	7	8.8–9.3	.96	8.97 ± .06	.148 ± .04	1.66 ± .44
dm^2						
L	5	8.6–9.5	-	9.14	—	—
W	5	6.8–8.3	-	7.38	—	—
dm^3						
L	7	10.2–12.9	5.64	12.19 ± .33	.87 ± .23	7.14 ± 1.9
W$_a$	7	7.4–8.5	2.36	7.81 ± .14	.36 ± .10	4.66 ± 1.3
W$_p$	7	10.1–11.4	2.14	10.79 ± .14	.38 ± .10	3.48 ± .93
dm^1						
L	13	11.9–14.4	4.26	12.95 ± .18	.66 ± .13	5.08 ± .10
W$_a$	13	10.7–12.8	3.63	11.92 ± .16	.56 ± .11	4.70 ± .92
W$_p$	13	10.9–13.0	4.11	12.02 ± .18	.64 ± .12	5.28 ± 1.0

There is no evidence that measurements on teeth in series are less accurate or consistent than those on loose teeth. Any note-

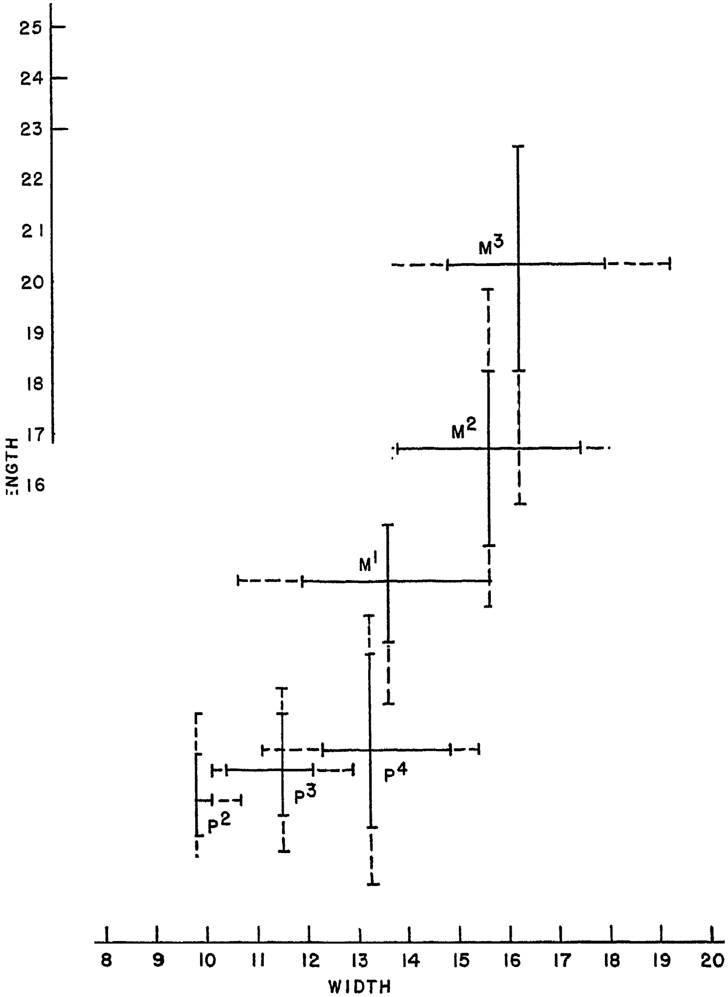

FIG 11. *Platygonus compressus*. Diagram of lengths and widths of upper cheek teeth from Cherokee Cave, St. Louis. For each tooth, as labeled, the intersection of the two lines is at the mean length and width. The solid lines represent observed range of the corresponding dimension, length in the case of vertical lines and width in the case of horizontal lines, and the dashed lines continue these to the calculated limits of the standard ranges. For M^{1-3} the length data are for teeth in series.

worthy difference in this respect would probably affect the coefficient of variation. In fact variation, by this index, is on an average smaller in the measurements made on the teeth in series.

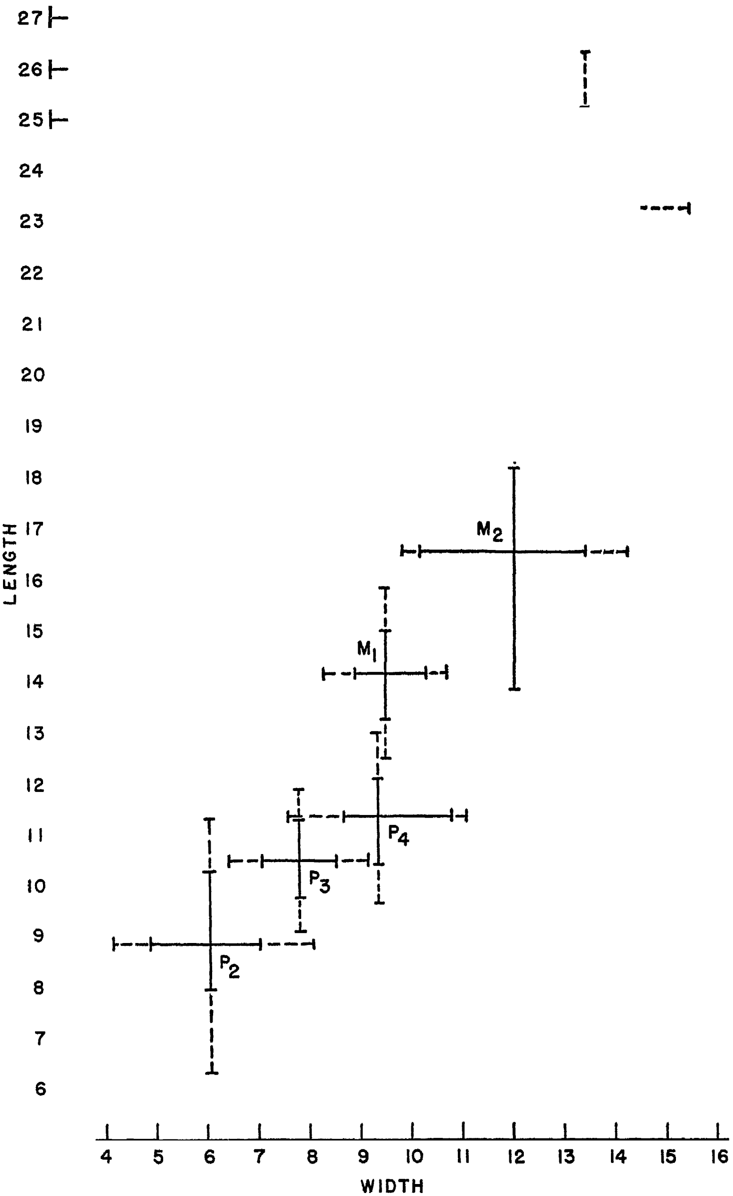

FIG. 12. *Platygonus compressus*. Diagram of lengths and widths of lower cheek teeth from Cherokee Cave, St. Louis. For P_3–M_3 the length data are for teeth in series. The construction of the diagram and its conventions are as in figure 11.

This is probably a chance result (the differences are not statistically significant, either individually or in their consistency among the eight variates), but in any case it opposes rather than favors the hypothesis that measurements in series are less reliable.

The variability in size of the various tooth dimensions is reasonably consistent throughout and seems to be about that usual

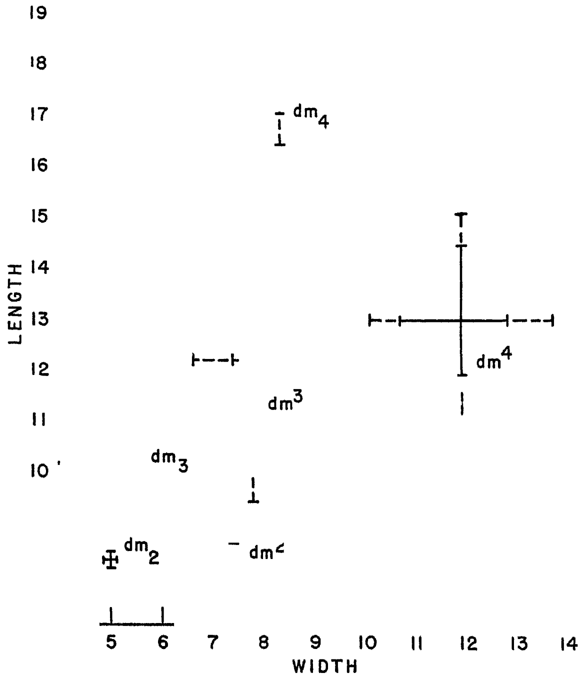

FIG. 13. *Platygonus compressus*. Diagram of lengths and widths of deciduous cheek teeth from Cherokee Cave, St. Louis. The construction of the diagram and its conventions are as in figures 11 and 12. Standard ranges are not given for the small samples of dm_{2-3} and dm^2.

for dimensions of functional teeth in most species of mammals. Almost all the coefficients of variation run in round numbers from 4 to 7. The only remarkably low V's are 2.8 for WP^2 and 1.7 for W_pdm_4 and these are for small samples (only 7 in each case) and probably are chance sample deviations below the population values. One tooth, P_2, has values of V considerably higher than those for any other tooth. The sample is so small that the sig-

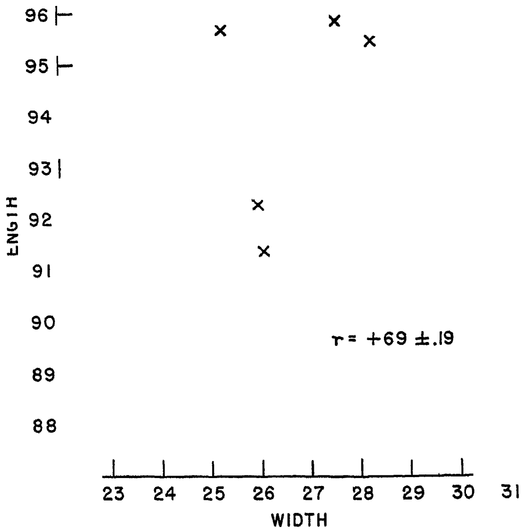

Fig. 11 *Platygonus compressus* Scatter diagram of corresponding lengths and median shaft widths of metacarpals (both sides) from Cherokee Cave, St. Louis.

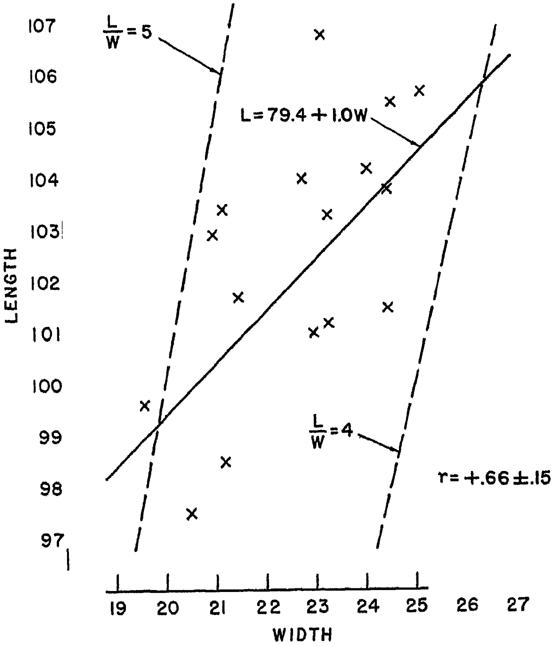

Fig. 15. *Platygonus compressus*. Scatter diagram of corresponding lengths and median shaft widths of right metatarsals from Cherokee Cave, St. Louis. The least-squares regression line is given (solid) as well as two ratio lines (broken)

nificance of these high values is somewhat dubious, but this may well be an unusually variable tooth in this population. It may be in process of evolutionary change (reduction?) or perhaps it shows some sexual dimorphism. It has been suggested (e.g., Gazin, 1938) that the premolars tend to be more slender in female than in male peccaries, but our series shows no clear evidence of association of cheek tooth size with sex.

The metapodials show no striking variations in structure, but they vary considerably in size and proportions. Statistical data are presented in table 6 and figures 14–16. Abbreviations are the same as for the cheek tooth statistics except that L is here maximum length between planes touching the proximal and distal ends of the bone and at right angles to its shaft, W is the minimum transverse width of the shaft, and the additional symbol r is used for the coefficient of correlation. The bones measured are all essentially adult, with the epiphyses at least partially fused and with the shafts of the two appressed metapodials also at least partially fused.

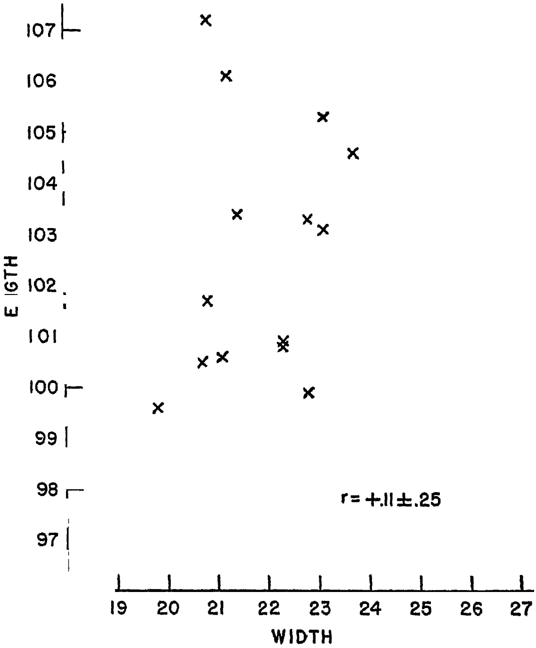

FIG. 16 *Platygonus compressus.* Scatter diagram of corresponding lengths and median shaft widths of left metatarsals from Cherokee Cave, St. Louis.

TABLE 6

STATISTICAL DATA ON METAPODIALS OF *Platygonus compressus* FROM ST. LOUIS

	N	OR	SR	M	σ	V
Metacarpals						
L	9	89.3–95.9	14.84	93.07 ± .76	2.29 ± .54	2.46 ± .58
W	9	23.0–28 3	11.60	25.70 ± .60	1.79 ± .42	6 98 ± 1.6
Right metatarsals						
L	17	97.5–106.8	15.88	102.49 ± .59	2.45 ± .42	2.39 ± 1.3
W	16	19.6–25.2	10.56	22.72 ± .41	1.63 ± .29	7.19 ± 1.4
Left metatarsals						
L	17	99.6–107.2	14.64	102.49 ± .55	2.26 ± .39	2.1 ± 2.30
W	17	19.8–25 9	7.39	22.25 ± .35	1.14 ± .25	6.49 ± 1.2
Total metatarsals						
L	34	97.5–107.2	15.29	102.49 ± .40	2.36 ± .29	2.38 ± .28
W	33	19.6–25.9	10.11	22.48 ± .27	1.56 ± .19	6.91 ± .85

The coefficients of variation for length are the same for metacarpals and metatarsals (within limits of probable sampling error) and are low. This relatively slight amount of variation probably reflects the functional importance of metapodial length and rather strong selection against variation in it. The width of shaft may be presumed to have less functional importance, or to have wider limits of structural tolerance, and the samples reliably show that this is a more variable dimension than length. The possibility that the bones continued to grow in width after they ceased to elongate may also be considered as a possible cause of greater variation in width, but this is not a probable or at any rate a sufficient explanation.

Statistics for the metatarsals, of which adequate samples were available, were calculated separately for right and left sides as well as for the total of both. No significant difference was expected or was found between M, σ, and V values for the two sides. There is, however, some probability that the whole sample includes some pairs of metatarsals from the two sides of the same animals, and these pairs would show individual correlation. The standard errors of the combined sample might then be spuriously low, and correlation of length and width might also be affected.

The correlation of length and width is not very close, and the relative slenderness of the metapodials is highly variable. For the metacarpals (an inadequate sample) the correlation coefficient r is +.69 ± .19, doubtfully significant statistically in so small a sample.

For the right metatarsals, $r = +.66 \pm .15$, which is significantly positive but does not suggest strong correlation. For the left metatarsals, r is only $+.11 \pm .25$, which is far from significant. This low sample result could be (and doubtless was) derived from a population in which the correlation was real and was as high as that for the right metatarsals, but it suggests that the correlation in the population was really lower than for our sample of the right metatarsals. It happens that among the left metatarsals there are two that are extraordinarily long and slender, a chance of sampling that reduces the correlation.

The least square regression line for our right metatarsal sample, the only one that gives a reasonably good regression, is $L = 79.4 + 1\ 0\ W$. Mean length increases at about the same absolute rate as mean width, and therefore at a lower relative rate. For small individuals with length around 100 mm. the ratio of length to width tends to be about 5, but for larger individuals with length around 105 mm., the ratio tends to be about 4.2, but with great variation in both cases. Metatarsals near the mean length may have length : width ratios from 4 to 5. The unusually long, slender left metatarsals mentioned above illustrate how radical this variation may be. They measure 107.2 and 106.1 mm. in length, but the ratios of length to width are 5.2 and 5.0, respectively, ratios as large as those of the shortest metatarsals in the collection. It is evident that relative elongation or slenderness of metapodials has relatively little taxonomic or functional significance in this group. It would seem advisable also to reëxamine some other groups in which importance has been given to moderate differences in metapodial proportions.

COMPARISONS WITH CLASSIC MATERIAL OF *P COMPRESSUS* AND WITH *P LEPTORHINUS* (= *P COMPRESSUS*)

Bearing in mind that Leidy's measurements (Leidy, 1853) were in no case more precise than to $^1/_4$ line, about .5 mm., and that a difference must be on that order to indicate any real difference in the actual measurement, Leidy's measurements of syntype and lectotype of *P. compressus* all fall within the observed range of the St. Louis series except LP^2. LP^2 of *P. compressus* syntype is outside the observed, but within the standard, range for the St. Louis sample, which has only seven measurements of this dimension. Leidy's measurements are, however, all below the means for the

St. Louis sample, and this is real in terms of the precision of Leidy's units except for WP². In other words, as far as these measurements are concerned, the types of *P. compressus* could represent small variants from a population not significantly different from that sampled by the St. Louis collection.

Although Williston's sample, type series for his *P. leptorhinus* (Williston, 1894b), is small, it does suffice to make a more secure statistical comparison with the St. Louis series. (Williston's measurements are given to whole millimeters only and are thus less precise than Leidy's; the means are of course more precise but not so much as might appear from their conventional presentation here to two decimal places.) The means for "*P. leptorhinus*" are all below those for the St. Louis sample except for LP², where the difference is only .2 mm. and both samples are small. In some cases the differences between the two lots are significant in a tech-

TABLE 7

COMPARISONS OF ST. LOUIS SPECIMENS OF *P. compressus* WITH THE SYNTYPE OF THAT SPECIES AND THE SYNTYPES OF *P. leptorhinus*

	Syntype, *P. compressus*[a]	Syntypes, *P. leptorhinus*[b]			St. Louis Series[c]		
		N	M	OR	N	M	OR
P²							
L	8.5	3	10.0	9–11	7	9.81	9.1–10.7
W	9.5	3	9.67	9–10	7	9.76	1.3–10.1
P³							
L		4	10.25	10–11	12	10.43	9.5–11.5
W	10.6	4	11.25	10–12	12	11.49	10.4–12.1
P⁴							
L	10.1	4	9.25	9–10	21	10.78	9.3–12.7
W	12.2	4	12.00	11–13	21	13.25	12.3–14.8
M¹							
L	-	5	12.60	11–14	19	14.08	12.9–15.2
W	-	5	12.20	12–13	29	13.57	11.9–16.0
M²							
L	–	4	16.00	15–17	17	16.71	14.8–18.2
W	-	4	14.25	14–15	34	15.59	13.8–17.4
M³							
L	-	2	19.50	19–20	14	20.26	18.2–22.6
W		2	14.00	14	26	16.20	14.8–17.9

[a] Measurements from Leidy, 1853, with lines converted to millimeters.

[b] Measurements from Williston, 1894b.

[c] The lengths are those of teeth in series, where these were separately tabulated; see tables 3 and 4

nical statistical sense. For instance P by Student's t test is well under .01 for the dimensions of M^1 and M_1 except WM_1, for which it is slightly above .05. These tests, when the available frequencies are large enough to show significance, and the almost complete consistency of the relationship, even for small frequencies, indicate that the population represented by Williston's measurements had the mean size of the cheek teeth smaller than that represented by ours. Comparisons with the types of *P. compressus* and of *P. leptorhinus* are given in tables 7 and 8.

TABLE 8

COMPARISONS OF ST. LOUIS SPECIMENS OF *P. compressus* WITH THE LECTOTYPE OF THAT SPECIES AND THE SYNTYPES OF *P. leptorhinus*

	Lectotype, *P. compressus*[a]	Syntypes, *P. leptorhinus*[b]			St. Louis Series[c]		
		N	M	OR	N	M	OR
P_2							
L	—	4	8.75	7–10	7	8.87	8.0–10.3
W	—	4	6.25	6–7	7	6.70	5.2–8.6
P_3							
L	—	4	10.00	10	14	10.56	9.8–11.3
W	—	4	7.75	7–8	25	8.59	7.8–10.2
P_4							
L	—	4	10.75	10–12	15	11.40	10.4–12.1
W	—	4	9.50	9–10	25	9.90	8.9–12.2
M_1							
L	—	6	12.33	10–15	15	14.22	13.3–15.0
W	—	6	9.83	9–11	19	10.25	9.7–11.0
M_2							
L	15.9	5	15.40	15–16	29	16.61	13.9–18.2
W	11.6	5	11.40	10–13	42	12.46	10.4–14.4
M_3							
L	21.2	5	21.20	20–23	18	23.36	21.5–25.3
W	12.2	5	11.60	11–12	13	13.37	12.0–14.6

[a] Measurements from Leidy, 1853, with lines converted to millimeters.

[b] Measurements from Williston, 1894b.

[c] The lengths are those of teeth in series, where these were separately tabulated; see tables 3 and 4.

There remains the possibility that the difference is in the measurements and not in the teeth, that is, that Williston's measuring technique tended to give smaller measurements on the same objects than does ours. This cannot be fully checked without remeasuring all of Williston's material, which has not been practi-

TABLE 9

COMPARISONS OF MEAN DIMENSIONS OF CHEEK TEETH OF *P. compressus* FROM ST. LOUIS WITH THOSE OF A SYNTYPE OF *P. leptorhinus*

	A.M.N.H. No. 10388[a]	St. Louis Mean
P_2		
L	10.0	8.87
W	6.65	6.70
P_3		
L	10.55	10.56
W	7.5	8.59
P_4		
L	10.7	11.40
W	8.8	9.90
M_1		
L_l	13.95	14.22
W_a	9.15	9.48
W_p	9.85	10.25
M_2		
L_l	15.85	16.61
W_a	10.75	12.06
W_p	11.5	12.46
M_3		
L_l	21.45	23.36
W_a	11.5	13.37
W_p	12.4	12.83
P^2		
L	9.05	9.81
W	8.95	9.76
P^3		
L	10.2	10.43
W	10.8	11.49
P^4		
L	9.35	10.78
W	12.3	13.25
M^1		
L_l	13.7	14.08
W_a	12.75	13.57
W_p	13.1	13.50
M^2		
L_l	15.2	16.71
W_a	14.6	15.59
W_p	14.4	15.01
M^3		
L_l	18.7	20.26
W_a	15.1	16.20
W_p	14.05	13.70

[a] Measurements taken on both sides and means entered.

cable for us because the specimens have been dispersed. One of them is, however, in our collection, and Mr. Altshuler has measured it by the identical technique used in measuring the St. Louis sample, with the result given in table 9. Of the 30 dimensions compared, the Kansas specimen is smaller than the St. Louis mean in all but two, LP_2 and W_pM^3. This is not absolutely conclusive, but the agreement with the trend of Williston's more numerous measurements leaves little reasonable doubt that the teeth in Williston's specimens really do average smaller than the means for ours.

In spite of this difference in mean size, the observed ranges of these dimensions overlap extensively in the Kansas and St. Louis groups, a fact all the more striking in view of the small size of some of the samples.

Of the 24 dimensions studied, the observed range of Williston's measurements is wholly within that of the larger St. Louis sample, rounded to the same units, in 15 cases. For eight dimensions Williston's observed range extends lower than that for the St. Louis peccaries but still overlaps the latter, a large variant from the Kansas sample being as large as, or larger than, a small variant from St. Louis. In only one case, WM^3, do Williston's figures fail to overlap ours, and in this case he gave only two measurements and reported them as equal, 14 mm., while our smallest specimen measures 15 mm., in round millimeters. Even here overlap undoubtedly existed in the samples. In fact, Mr. Altshuler's more precise measurement of WM^3 on one of Williston's specimens is 15.1, which is within the St. Louis observed range although still well below its mean.

In tooth dimensions, Williston's specimens differ less from the lectotype and syntype specimens of *P. compressus* than do the St. Louis specimens. Leidy's referred specimens of *P. compressus*, essentially informal neotypes, also have teeth that tend to be smaller than those from St. Louis and that are not evidently different from Williston's specimens.

In distinguishing *P. leptorhinus* from *P. compressus*, Williston (1894b) did not rely on tooth measurements, which reveal no significant difference, but on minor morphological differences from Leidy's figures of referred, not type, skulls and jaws supposedly of *P. compressus* and especially the young skull that Leidy first named *Euchoerus macrops*. On restudying one of Williston's specimens, of about the same age as the "*Euchoerus*" skull, Peterson (1914) denied significance or reality to some of the supposed differences tentatively signalized by Williston, but concluded that the Williston specimen, and hence *P. leptorhinus*, differed from "*Euchoerus macrops*," hence by inference from *P. compressus*, in having the symphysis of the lower jaw heavier, with a more extended protuberance on the chin, in having shorter postcanine diastemata, and in having the jaws generally more robust and the face wider.

These differences, too, are deprived of probable specific validity by comparison with our more extended series of specimens. There can be little doubt that the St. Louis peccaries represent a single specific population, but among them are variants that match Williston's material (especially A.M.N.H. No. 10338, directly compared) closely in weight and protuberance of the symphysis, in length of diastema, and in width of face, and others that match Leidy's figured specimens equally well in these particulars.

As regards depth of lower jaw, our St. Louis specimens with P_4 erupted and the ramus well preserved give the following data for depth of ramus on the outer side from the alveolar margin at the middle of P_4 to the lower rim in a vertical from the alveolar line:

N	OR	SR	M	σ	V
8	40–44	8 51	41 50 ± .58	1.32 ± .33	3.19 ± 80

A.M.N.H. No. 10338, a syntype of *P. leptorhinus*, measures 48 mm. in this dimension and is thus significantly deeper than the jaws from St. Louis. However, the whole series of syntypes of *P. leptorhinus* measured by Williston has an observed range of 35–49 and a mean of 43.33 mm. Although this mean is higher than that for St. Louis, the difference is not statistically significant (by the *t* test, which gives P greater than .3), and Williston's observed range not only overlaps but also completely includes ours.[1] In other words, Williston's series does not have significantly heavier jaws than ours; it is simply more variable than ours, so that some individual variants are significantly larger and some are significantly smaller than our series.

In all this there is nothing that would warrant or permit placing the types of *P. compressus*, Leidy's referred specimens, Williston's syntype series of *P. leptorhinus*, and our series from St. Louis in more than one species. All are placed in *P. compressus*, of which *P. leptorhinus* is a synonym.

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[1] Williston did not well specify the dimension he measured, but check on our Williston syntype and on Leidy's and Williston's figures shows it as sufficiently near ours to warrant comparison

It is nevertheless clear that as populations, that represented by Williston's Kansas specimens is somewhat different from that represented by the series from St. Louis. Their variations fully intergrade and many individuals could not well be distinguished taken separately, but the mean size of their teeth (and perhaps some other averages for details) are somewhat different. They represent slightly different segments of one specific population. The Kansas specimens, apparently killed and buried simultaneously and together, may well be a single family group. The St. Louis specimens are too numerous to represent one family only, but probably are all from one local race, perhaps a single herd. The two different series are not likely to be exactly contemporaneous.

The two series could be regarded either as different geographic races or subspecies or as successive samples of a population changing with the passage of time. Choice between the two alternatives is impossible from the available information, and both geographic and temporal factors may be involved. It would be legitimate to apply separate trinomials (but not binomials) to the two groups, but this would be rather pointless at present. There were probably many local and temporal groups equally or more distinctive within this wide- and long-ranging species. It would be of great interest to be able to plot this subspecific differentiation for a Pleistocene species, and *P. compressus* seems to be promising in this respect. Recognition of some small-scale distinction in these two groups is a step in that direction, but many more such samples need to be gathered and analyzed in a similar way before a clear picture will be available. Subspecific nomenclature applied now would be premature and might complicate the eventual solution.

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SPECIES OF THE GENUS *SAEMUNDSSONIA* (MALLOPHAGA) FROM THE STERNINAE

By Theresa Clay

The species of *Saemundssonia* from the Sterninae, owing to their general uniformity of appearance, have been regarded by many authors as belonging to one species; Harrison, 1916, placed all the species from the European terns as synonyms of *S. melanocephalus* (Burmeister) However, an examination of the male genitalia shows that there are a number of distinct and easily recognizable species, making it necessary to reëstablish the earlier names. The descriptions of the early authors did not include the characters of the male genitalia, and in general their species are only referable to the genus. It is reasonably certain that the material on which Linné's species was based is no longer in existence. Dr. Kéler informs me that there is no doubt that the Halle collection which contained the greater part of the type material of the Nitzsch, Giebel, Taschenberg, Burmeister, and some of the Rudow species was, with the exception of the Goniodidae, *sensu lato,* and Trichodectidae, *sensu lato,* totally destroyed during the late war. Through the kindness of Dr. Eichler and Signor Conci I understand that the material on which Olfers and Picaglia based their descriptions is unlikely to be found, the Piaget material is virtually complete. This inadequacy of the descriptions and loss of the type material mean that the only satisfactory method of fixing the earlier names is to select a species from the original host, the characters of which do not conflict with the original description, and to erect neotypes. It is important that the neotypes should be selected from a subspecies of the host that could have been the original one, and for this reason no erection of neotypes for *brevicornis* Giebel (see below) has been made. At the present time it is impossible to give a name to a specimen of *Saemundssonia* from any tern which makes it generally recognizable, and thus all previous records of *Saemundssonia* are valueless. *S. melanocephalus* (Burmeister), as restricted below, is a distinctive species known only from *Sterna albifrons*, but it has been recorded from nearly all the European, South African, and New World terns in addition to many of the gulls. For this reason references to the species in the early literature are discussed only where these are relevant to the fixing of the name. An exception is made in the case of Piaget, for the reason that this author has been and still is taken as an authority on the synonymy of the Nitzsch-Burmeister-Giebel names. In fact, in the majority of cases Piaget merely made his deductions from the published descriptions, often redescribed and figured species from the wrong host, and in some cases the fact that he mentions the correct host does not necessarily mean that he had seen material from it. His interpretations are often incorrect and cannot be accepted. A glance through the specimens in the Piaget collection listed below under the species shows many cases of straggling and misdetermination; his host records should not, therefore, be accepted without further confirmation.

Paratypes and examples of all the species available have been deposited in the American Museum of Natural History.

VARIATION: The *Saemundssonia* species here considered are heavily sclerotized forms, and such species are liable to show considerable variation in the extent and shape of the sclerites from specimen to specimen, and from side to side of the same specimen. In these species, in addition to and surrounding the definite sclerites of the thorax and abdomen, there are further sclerotized areas. The extent and pigmentation of these secondary areas appear variable, and in some specimens examined the true sclerites may have their outline obscured, resulting in the apparent fusion of sclerites which are actually distinct. For this reason the exact outlines of the sclerites cannot be used as diagnostic characters.

An indication of the range of variation found throughout one species is shown under *sternae,* of which a good series has been examined; it is probable that other species show a comparable range of variation.

HOST DISTRIBUTION: The distribution of the species of *Saemundssonia* found on the Sterninae will be discussed elsewhere.[1]

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[1] Paper in press.

Here attention can be drawn to the anomalous occurrence of *S. sternae* (Linné) on *Gelochelidon nilotica*, which cannot be explained by either contamination or misidentification of hosts (three different hosts from three localities), and the close relationship of the species from *Sterna aurantia* and *Chlidonias* sp. Specimens from all species of *Thalasseus* examined (with the exception of those from *T. maximus* and *T. eurygnatha*) appear to be conspecific, and similarly with those from all the species of *Chlidonias*. It is possible that when large series of specimens are available, it will be found that each host species has a distinct subspecies of *Saemundssonia*. For this reason the measurements of the head breadth (tables 6 and 7) of specimens from the different host species are given separately.

There is an interesting correlation between size of parasite and size of host. Harrison (1915, p. 96) was the first author to draw attention to the principle which appears to have a wide application. If the three related species of *Saemundssonia* (*sternae*, *melanocephalus*, and *laticaudata*) are considered (tables 6 and 7), it is seen that the smallest parasite, *melanocephalus*, is found on the smallest host, *Sterna albifrons;* and the largest, *laticaudata*, on the largest host, *Thalasseus sandvicensis;* the parasite of intermediate size, *sternae*, being found on *Sterna hirundo*, which is intermediate in size between the two former hosts.

Owing to the great similarity between some of the species of *Sterna* (e.g., *hirundo, paradisaea,* and *vittata*) considerable caution must be used in accepting host identifications; only those specimens about the host of which there is no doubt have been used for types or neotypes. The host name as given in the original description is used for the first mention of the parasite followed by its present equivalent and author according to Peters (1934, p. 327).

MEASUREMENTS: It has been found that the breadth of the head at the temples in *Saemundssonia* species remains fairly constant under different treatments in mounting. This measurement is relatively constant for the species and in one case forms the most satisfactory character by which two species can be separated in the females. It is a more useful criterion of specific differences than the caphalic index, as (except in the case of male *hopkinsi*, new species) the proportions of head breadth to length are relatively constant. The measurements for the main divisions of the body are given only for the type specimens as a general indication of size and should not be used as a basis for erecting new subspecies. Length measurements are taken along the midline for the head (including the hyaline margin), and from the most anterior lateral dorsal point to the most posterior point for the thorax and abdomen; the cephalic index (C.I.) is breadth:length.

KEY TO SPECIES[1]

MALES

1. Basal plate with distal sclerotized cross bar (figs. 20, 21).............. 2
Basal plate without distal cross bar................................ 3
2. C.I. > 1.03; length of paramere > 0.24 mm... ....*lobaticeps*
C.I. < 1.05; length of paramere < 0.28 mm.....................*hopkinsi*
3. Endomere with terminal, strongly sclerotized, tooth-like process (fig. 29)
....*melanocephalus*
Endomere without above process......... 4
4. Linear arrangement of mesosomal setae (fig. 26)............*laticaudata*
Clustered arrangement of mesosomal setae (fig. 22).....................5
5. Details of endomere and paramere head as in figures 16, 22, 23......*sternae*
Details of endomere and paramere head as in figures 17, 24, 25......*lockleyi*

FEMALES

1. Hyaline anterior margin of head medianly emarginate...................2
Hyaline anterior margin of head not emarginate........................3
2. Breadth at temples usually > 0.72; setae lateral to last abdominal sternite 5–7 in number; shape of signature as in figure 14........*lobaticeps*
Breadth at temples usually < 0.73; setae lateral to last abdominal sternite 3, occasionally 4, in number; shape of signature as in figure 15.*hopkinsi*
3. Sternite VII with posterolateral angles free or partially fused to subgenital plate...*sternae, vittata*
Sternite VII with posterolateral angles fused to subgenital plate..........4
4. Breadth at temples > 0.60 mm.........................*melanocephalus*
Breadth at temples < 0.63 mm..........................*laticaudatus*

Saemundssonia sternae (Linné), 1758

Figures 1–6, 16, 22, 23

Pediculus sternae LINNÉ, 1758, p. 612. Hosts: "Habitat in Sternis, Laris."

Nirmus fornicatus OLFERS, 1816, p. 89. Hosts: "Hab. in laris et sternis."

Docophorus 5-maculatus PIAGET, 1885, p. 9. Host: *Hirundo urbica* = *Chelidon u. urbica* (Linné).

Pediculus sternae Linné (1758, p. 612) has no description but a reference to "Fauna Suecica" (1746, p. 339) and to Redi (1668), plate 9, figure 2. The description in "Fauna Suecica" mentions a

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[1] *Saemundssonia peristicus* and *S snyderi* omitted.

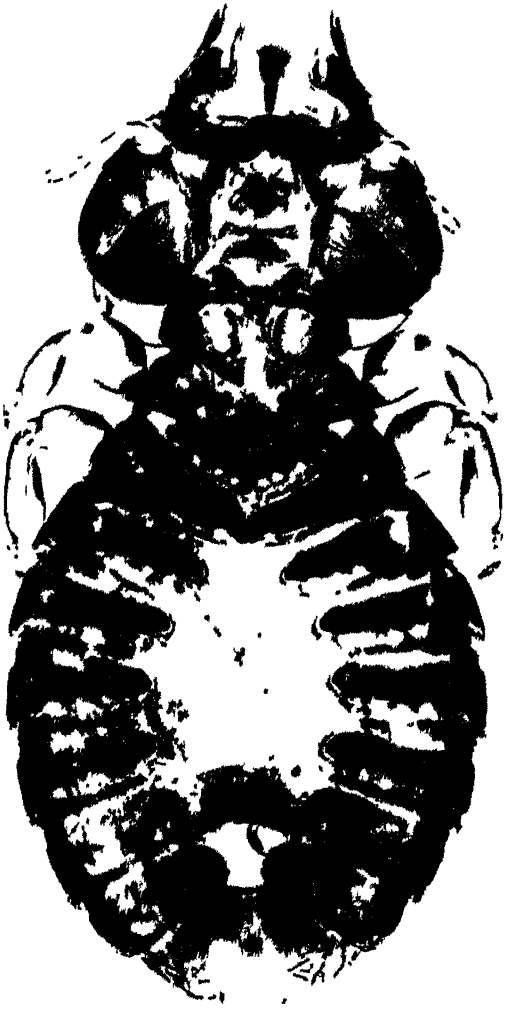


Fig. 1 *Saemundssonia sternae*, female.

triangular head which is only applicable to *Saemundssonia* or *Quadraceps* among the species found on *Sterna*. The description suggests the former, an interpretation confirmed by Redi's figure, which although poor must be taken to represent a *Saemundssonia.* The host record in 1758 is "habitat in Sternis, Laris." Linné always gave a secondary appellation to his species, derived from a specific name of a host, before he gave the host record, such as "habitat in Sternis." This secondary appellation is taken to be a definite restriction of type host. In the case of *sternae*, the secondary appellation is *P. sternae hirundinis;* the only host given in "Fauna Suecica" is "*Sterna secunda* 128" (= *Sterna h. hirundo* Linné). *Pediculus sternae* Linné is therefore considered to be the earliest name for the *Saemundssonia* species described below, with *Sterna h. hirundo* as type host.

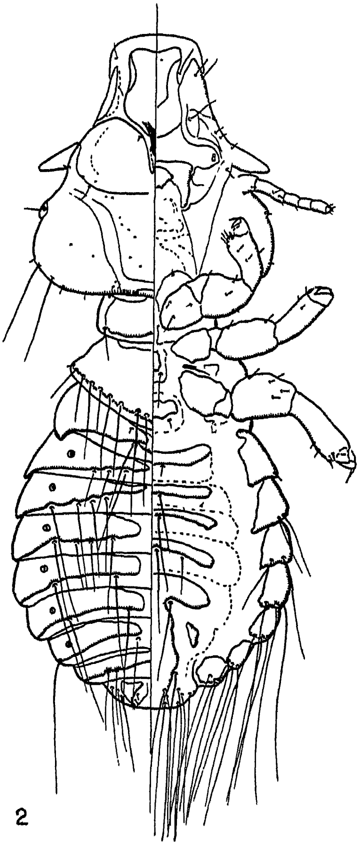
Nirmus fornicatus Olfers is a composite species; the description undoubtedly refers to a *Saemundssonia.* The host record is "Hab. in laris et sternis," and there are references to *P. sternae* Linné, the left-hand figure of Redi's plate 9, and to *Ricinus lari* De Geer, excluding the figure. As there is no restriction of type host in the original description, the name *fornicatus* Olfers is here restricted in such a way as to make it a synonym of *Saemundssonia sternae* (Linné).

Docophorus 5-maculatus Piaget was described from specimens alleged to have come from *Hirundo urbica* [= *Chelidon u. urbica* (Linné)]. These specimens are in the Piaget collections (one male, one female in the British Museum, one male, one female in the Rijksmuseum, Leiden) and prove to be *Saemundssonia sternae* (Linné). The specimens must have come from *Sterna hirundo,* and the explanation of the error is probably confusion between the names *Hirundo urbica* and *Sterna hirundo.*

MALE: Head (fig. 2) with general arrangement of sclerotized bands typical for the genus. Anterior hyaline margin flattened; clypeal signature with anterior margin flattened or slightly concave, and projecting beyond point of fusion of internal and marginal bands. The median dorsal pre antennal suture varies in the extent of its posterior prolongation. In some specimens it may reach to the level of the posterior margin of the coni. The chaetotaxy shows no individual variation except in the number and position of the minute setae on the dorsal postantennal region. The number and arrangement of the larger setae are constant for all the species described below.

Thorax as shown in figure 2. There is variation in the extent of the sclerotization, and hence in the shape, of the sternal plates. The number of elongate setae on the dorsal posterior margin of the pterothorax varies from seven to 10 each side in the specimens examined, and the number is not necessarily symmetrical each side of the same specimen.

Abdomen as shown in figure 2. Segment II with tergal plates



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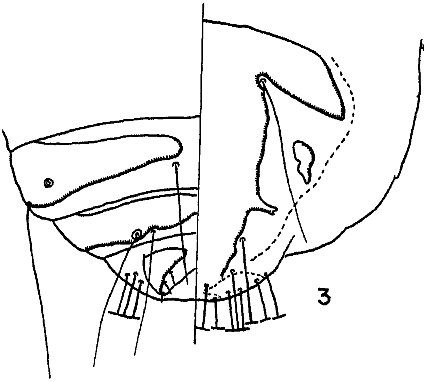

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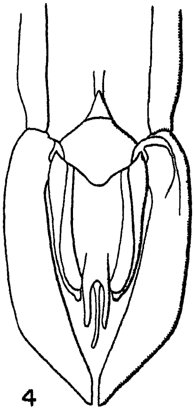

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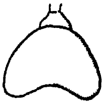

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FIG. 2. *Saemundssonia sternae*, male.
FIG. 3. Terminal segments of abdomen, male.
FIG. 4. Male genitalia.
FIG. 5. Uncus.

approximate or in contact medianly, and joined together by well-marked secondary sclerotization. As mentioned above, there is considerable variation in the area and thickness of the primary sclerites and of the surrounding secondary sclerotization. This, together with a varying amount of overlapping of the segments, probably owing to different methods of treatment, results in a certain amount of variation in the general appearance of the abdomen. The subgenital plate has an irregular and variable outline (cf. figs. 2 and 3). The ventral posterior margin of the abdomen may have a rounded or flattened appearance. The normal variation of the abdominal setae is shown in table 1, but there may be plus or minus one to two setae each side; specimens are rarely symmetrical on each side in respect to the chaetotaxy. There are, in addition, a number of minute setae on the dorsum of some specimens which are not included in the table. On the venter there are fewer setae and less variation in number. One specimen examined had the minute setae on segment III elongate and reaching to segment V. One specimen lacked the elongate setae on segment VII. In some specimens the minute setae (not shown in table), usually present on segments III–V, lateral to the normal one on each side, become enlarged and elongated on one or more segments. The pleural setae appear to be more constant in number than those of the dorsum and venter.

Genitalia as shown in figures 4, 5, 16, 22, and 23. Specific characters are the absence of a sclerotized cross bar at the distal end of the basal plate, endomeral projections not fused medianly, details of the proximal head of the paramere, and the extension of the penis well beyond the telomeres. There appears to be little true variation in the parts, but owing to distortion in mounting there may be considerable apparent variation, especially in the shape of the distal end of the endomeres. The anterior margin of the sclerotized mesosomal plate at the distal end of the basal plate (the *uncus* of Waterston, 1915, p. 172) varies in outline (as shown in figs. 4 and 5). It may have a flattened or concave posterior margin.

FEMALE: Head and thorax (fig. 1) as in male, but the measurements are greater (tables 4, 5, and 7).

Abdomen is longer and broader than in the male (fig. 1). Segment II with tergal plates as in male. Segments III–VIII with tergal plates separated widely medianly; IX and X with fused transverse plate; XI with distinct tergal plate each side. Segment II with median sternal plate, irregular in outline and varying in area; in some specimens it is not apparent. Segments III–VI with small, well-marked lateral plates and narrow median plates showing variation in extent, and not apparent in all specimens. The unpigmented parts of the venter of the abdomen show the ornamented appearance as figured by Ferris (1932, fig. 20c) for the species he calls *snyderi.* Pleurites as in male. As in the male there is variation in the thickness and extent of the sclerites and the areas of secondary sclerotization. This fact is especially important in comparing the subgenital plates of the different species. The following characters of the subgenital plate appear to be rel-

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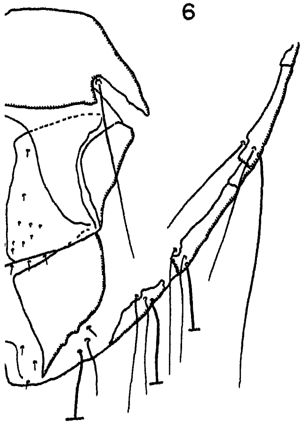

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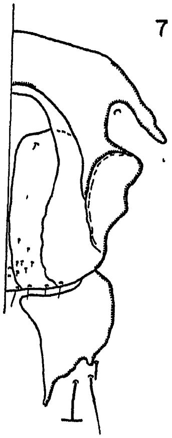

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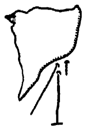

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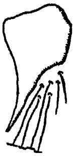

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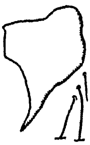

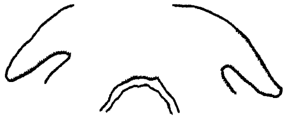

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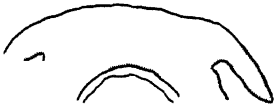

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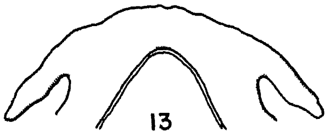


FIG. 6. *Saemundssonia sternae*, subgenital plates, female.
FIG. 7. *Saemundssonia laticaudata*, subgenital plates, female.
FIG. 8. *Saemundssonia melanocephalus*, last abdominal sternite, female.
FIG. 9. *Saemundssonia lobaticeps*, last abdominal sternite, female.
FIG. 10. *Saemundssonia hopkinsi*, last abdominal sternite, female.
FIG. 11. *Saemundssonia melanocephalus*, sternite VII, female.
FIG. 12. *Saemundssonia lobaticeps*, sternite VII, female.
FIG. 13. *Saemundssonia hopkinsi*, sternite VII, female.

atively constant for *sternae:* anterior and posterior margin of sternite VIII flattened, not curved into an arch-like effect, however, in the series of *S. lockleyi,* new species, there are some specimens with sternite VII flattened and some with it arch-like. This may therefore not be a reliable character in *sternae.* In *sternae* the posterior margin of sternite VII is not fused laterally to the subgenital plate (cf. figs. 6 and 7). There is, however, a band of secondary sclerotization which runs across the gap between sternite VII and the plate, and in heavily pigmented specimens this may give the superficial appearance of fusion. In one specimen on one side, the posterior margin of sternite VII is drawn out as a narrow strip and fused to the subgenital plate, and in one specimen of *lockleyi,* sternite VII has a narrow strip each side fused to the plate, thus resembling the condition in figure 7. The chaetotaxy and its normal variation are shown in table 1.

TABLE 1
Abdominal Chaetotaxy

	Male			Female		
	T	S	P	T	S	P
II	2–6	2	0, 0	2–6	2	0, 0
III	6–10	2	1, 1	6–12	2	1, 1
IV	8–12	2	2, 2	8–12	2	2, 2
V	10–12	2	2, 2	8–12	2	2, 2
VI	8–10	4	3, 3	8–12	4	3, 3
VII	4–6	2	3, 3	4–10	2	3, 3
VIII	4	fig	3, 3	4–6	fig	3, 3
IX–X	4	fig.	3, 3	4	fig.	3, 3

MATERIAL FROM TYPE HOST EXAMINED: Fifty-six males, 50 females from *Sterna h. hirundo* Linné, from Sweden, Estonia, Great Britain, Eire, Syria, and South Africa.

OTHER MATERIAL EXAMINED: Eight males, nine females from *Gelochelidon n. nilotica* (Gmelin) from Sudan, Ceylon, and Rajputana, India.

TYPE MATERIAL: Neotype (male) and neallotype (female) of *Saemundssonia sternae* (Linné), slide No. 16151 in the Meinertzhagen collection, from skin of *Sterna h. hirundo* Linné, Sweden. Neoparatypes: Fifty-four males and 48 females from the same host species, localities as listed above.

Neotype (male) and neallotype (female) (agreeing with description and figures of *sternae*) of *Saemundssonia fornicatus* (Olfers), slide No. 1340 in the Meinertzhagen collection, from *Sterna h. hirundo*, Estonia.

Lectotype of *Saemundssonia 5-maculatus* (Piaget), male, slide No. 597 in the British Museum Piaget collection, from *Hirundo urbica* (in error).

Saemundssonia lockleyi, new species

Figures 17, 24, 25

This species is close to *S. sternae*, from which it can be distinguished only by the male genitalia.

MALE: Head, thorax, and abdomen as in *sternae*. Male genitalia (figs. 17, 24, 25) with following characters distinguishing *lockleyi* from *sternae:* details of proximal head of parameres, shape of endomeres and telomeres, and details of mesosome.

FEMALE: No reliable character can be found on which to separate the females of this species from those of *sternae*.

Described from two males and six females from *Sterna vittata georgiae* Reichenow from Wiencke Island, Palmer Archipelago.

OTHER MATERIAL EXAMINED: Fourteen males, 25 females from *Sterna vittata bethunei* Buller from Campell Island; 10 males, 12 females from *Sterna paradisaea* Pontopiddan from East Greenland, Spitzbergen, Scotland, and the Antarctic.

TYPE MATERIAL: Holotype (male) and allotype (female), slides Nos. 314 and 315 in the British Museum collection, from *Sterna vittata georgiae* Reichenow, locality as above. Paratypes: One male and five females from the same host species and locality.

The type material was presented to the British Museum by the Falkland Islands Dependencies Survey Committee. The species is named in honor of Mr. G. J. Lockley who collected the specimens. The material from *S. v. bethunei* was seen through the kindness of Dr. Falla, Canterbury Museum, Christchurch, New Zealand.

Saemundssonia melanocephalus (Burmeister), 1838

Figures 8, 11, 19, 28, 29

(*Docophorus melanocephalus* NITZSCH, 1818, p. 290, *nomen nudum*)

Docophorus melanocephalus BURMEISTER, 1838, p 426. Hosts: "Auf mehreren *Sterna* und *Larus* Arten."

Nirmus melanocephalus GIEBEL, 1861, p. 315. Host: *Sterna minuta* = *Sterna a. albifrons* Pallas.

The first appearance of this name (Nitzsch, 1818, p. 290) is as a *nomen nudum*. Burmeister (1838, p. 426) gives a description which can be taken to apply to a *Saemundssonia*, but without exact host. As he was the first to describe the species he is the author of the name. Giebel (1861, p. 315) lists the name under *Nirmus*, without a description but with the host *Sterna minuta* (= *Sterna a. albifrons*). He refers to Nitzsch, 1818, Burmeister and Nitzsch MS. These references undoubtedly mean that the species he mentions is the one previously described by Burmeister, and the placing of the species in *Nirmus* must have been an error. Giebel (1874, p. 110) described and figured *D. melanocephalus*, giving as hosts *Larus ridibundus*, *Sterna caspia*, and *S. cantiaca*, with the remark "auf letzen beiden mit besonderen, wenn auch nur geringfugigen Eigenthumlichkeiten." This would seem to be a clear restriction of host to *Larus ridibundus*, but it is considered, as further discussed below, that the 1861 reference must take precedence and that *Sterna a. albifrons* is the type host of *melanocephalus*. Mr. G. H. E. Hopkins, in a private communication, has pointed out that this name cannot be discussed apart from *Docophorus karicola* and states "this latter name makes its first appearance in 1861 [Giebel, 1861, p. 315] as a *nomen nudum*, the hosts mentioned being *Sterna leucoparia* and *Larus ridibundus;* in 1866 [p. 363] Giebel again mentions it, the hosts being '*Sterna canthiaca, leucoparia, Larus ridibundus.*' His treatment of the name in 1874 (p. 110) is most extraordinary. He first sinks it to *melanocephalus* Burmeister, then immediately afterwards describes it as a good species from *Sterna leucoparia*. As this is the first valid appearance of the name, there is no doubt that (whatever may have been Nitzsch's original intentions) *Saemundssonia laricola* must have *Sterna leucoparia* [= *Chlidonias h. hybrida* (Pallas)] as its type host. Reverting to *melanocephalus*, it is perfectly clear that Giebel's 1874 list of hosts is complicated by the addition of two hosts (*Larus ridibundus* and *Sterna "canthiaca"*) which had been attributed to *laricola*, while it remained a *nomen nudum*, and the apparent restriction to the *Larus* therefore cannot be accepted. The third host mentioned, *S. caspia*, is the type host of Giebel's own *nomen nudum, Docophorus caspicus* (1866, p. 362). But can we accept the fact that in 1861 Giebel mentioned *Sterna minuta* as the sole host as a legitimate restriction of *melanocephalus?* It seems to me that we can and must. A most important fact in this connection is that Nitzsch, Burmeister, and Giebel all worked on the same material, though additions were made to the collection after Nitzsch's death. Giebel's 1861 paper is a list of the material then in the Nitzschian collection, and it seems clear that the only specimens of *melanocephalus* which were labeled with this name were those from *Sterna minuta.* These specimens must, therefore, be regarded as Burmeister's type series."

MALE: General characters of head, thorax, and abdomen as in *sternae.* The breadth of the head tends to be smaller (table 6), but the proportions are the same (table 5). The genitalia (figs. 19, 28, 29) are distinguished from all other species mentioned here by the characters of the paramere head, endomeres, and mesosome.

FEMALE: General characters as in *sternae,* but measurements tend to be smaller (tables 4, 5, 7). Sternite VII is fused to the subgenital plate as in *laticaudata;* the inner anterior angle of the last sternal plate each side is pointed and more heavily sclerotized (fig. 8). The females can also be distinguished from *laticaudata* by the considerably smaller measurements of the head and by the greater length of sternite VII in the midline, usually actually, and always proportionally to length of abdomen (fig. 11).

MATERIAL FROM TYPE HOST EXAMINED: Twenty-two males and 18 females from *Sterna a. albifrons* Pallas from Egypt and Scotland.

TYPE MATERIAL: Neotype (male) and neallotype (female) of *S. melanocephalus* (Burmeister), slide No. 4674 in the Meinertzhagen collection, from *Sterna a. albifrons,* Egypt. Neoparatypes: Twenty-two males and 17 females from the same host species, localities as listed above.

Piaget (1880, p. 109, pl. 9, fig. 5) described and figured a *Saemundssonia* under the name *Docophorus melanocephalus* Nitzsch from *Sterna cantiaca* (= *Thalasseus s. sandvicensis*) and recorded it also from *Larus cirrhocephalus.* The Piaget collection at Leiden contains one female *Saemundssonia* (not examined critically) from *Sterna cantiaca.* The British Museum Piaget collection contains two males and four females of *Saemundssonia laticaudata* (Rudow) (slides Nos. 900, 901) from *Sterna cantiaca,* one male and one female of *S. sternae* (Linné) (slide No. 902) from *Sterna cantiaca* (presumably stragglers from *Sterna hirundo*), and one male of a *Saemundssonia* not dealt with in this paper (slide No. 903) and presumably a straggler. The specimen from *Larus cirrhocephalus* is missing.

Saemundssonia laticaudata (Rudow), 1869

Figures 7, 18, 26, 27

Docophorus laticaudatus RUDOW, 1869, p. 12. Host: *Sterna cantiaca* = *Thalasseus s. sandvicensis* (Latham).

?*Docophorus brevicornis* GIEBEL, 1874, p. 112. Host: *Sterna acuflavida* = *Thalasseus sandvicensis acuflavidus* (Cabot).

There is nothing in Rudow's original description which prevents this name's being used for the *Saemundssonia* species on *Thalasseus s. sandvicensis* (Latham). No specimens have been seen from the type host of *brevicornis* = *Thalasseus sandvicensis acuflavidus* (Cabot), but it is probable that the two subspecies of *sandvicensis* have the same subspecies of *Saemundssonia*. As the type of *brevicornis* is no longer in existence, the name is placed provisionally as a synonym of *laticaudata* but remains available for the species from the type host if this should prove to be distinct from that on *T. s. sandvicensis*.

MALE: General characters of head, thorax, and abdomen as in *sternae*. All measurements tend to be larger, especially of the head, but the proportions are the same (tables 4–6). The genitalia are distinguished from *sternae* by the characters of the paramere head, endomeres, and mesosome (figs. 18, 26, 27).

FEMALE: General characters of head, thorax, and abdomen as in *sternae*, but, as in the male, all measurements tend to be greater. Sternite VII is fused to the subgenital plate (fig. 7).

MATERIAL FROM TYPE HOST EXAMINED: Four males and eight females from *Thalasseus s. sandvicensis* (Latham) from England and Mauretania.

OTHER MATERIAL EXAMINED: Six males and three females from *Thalasseus benghalensis par* (Mathews and Iredale), Aden and Port Sudan; 12 males and 10 females from *Thalasseus bergi velox* (Cretzschmar), Red Sea; and two males and two females from *Thalasseus b. bergi* (Lichtenstein), southwest Africa.

TYPE MATERIAL: Neotype (male) and neallotype (female) of *S. laticaudata* (Rudow), slide No. 313 in the British Museum collection (presented by G. H. E. Hopkins) from *Thalasseus s. sandvicensis*, Norfolk, England. Neoparatype: Three males and eight females from the same host species, localities as listed above.

Specimens from two South American species of *Thalasseus*, *T. m. maximus* (Boddaert) and *T. eurygnatha* (Saunders), do not appear to be quite typical of the above and may prove to be new subspecies.

Saemundssonia peristica (Kellogg and Kuwana), 1902

Docophorus peristicus KELLOGG AND KUWANA, 1902, p. 462. Host: *Sterna fulginosa* = *Sterna fuscata crissalis* (Lawrence).

This species was described from material taken from *Sterna fuscata crissalis* (Lawrence), and allegedly from *Dendroica aureata* = *D. petechia aureola* Gould and *Nesomimus carringtoni* = *N. barringtoni* Rothschild. The figure is undoubtedly that of a *Saemundssonia*, and the occurrence of this species on the two passerine hosts must have been due to contamination. This species is discussed below under *S. snyderi*.

Saemundssonia snyderi (Kellogg and Paine), 1910

Docophorus snyderi KELLOGG AND PAINE, 1910, p. 124. Host: *Sterna lunata* Peale.

No information is available on the types of *S. peristica* or *S. snyderi*, nor have specimens been seen from the type hosts. It is not, therefore, possible to resolve the present confusion which has arisen over these two names, resulting from the redescription of alleged *snyderi* from the type host of *peristica* (see Ferris, 1932, p. 71). In this redescription no mention is made of *peristica* or whether or not the types of *snyderi* were examined. *S. snyderi* (*sensu* Ferris, 1932) appears from the figures to be near *laticaudata*.

Saemundssonia lobaticeps (Giebel), 1874

Figures 9, 12, 14, 20, 30, 31

Docophorus lobaticeps GIEBEL, 1874, p. 109. Hosts: *Sterna hirundo* and *Sterna fissipes* = *Chlidonias n. nigra* (Linné).

?*Docophorus pustuliferus* PICAGLIA, 1885, p. 3. Host: *Hydrochelidon surinamensis* = *Chlidonias nigra surinamensis* (Gmelin).

(*Docophorus laricola* Nitzsch, GIEBEL, 1861, p. 315, *nomen nudum.*)

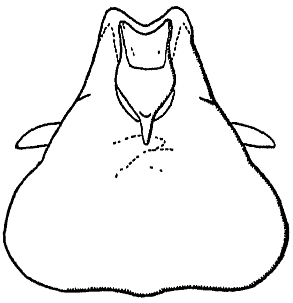
(*Docophorus laricola* Nitzsch, GIEBEL, 1866, p. 363, *nomen nudum.*)

Docophorus laricola Nitzsch, GIEBEL, 1874, p. 110. Host: *Sterna leucoparia* = *Chlidonias h. hybrida* (Pallas)

Docophorus lobaticeps was described from specimens alleged to have come from *Sterna hirundo* and *Chlidonias nigra*. However, there seems little doubt that the original description must have been made from a specimen from *Chlidonias nigra*. The characters separating *Saemundssonia sternae* (from *Sterna hirundo*) from the *Saemundssonia* of *Chlidonias nigra* are the emarginated hyaline margin of the head in the latter species, and (in the male) the usually greater width of the head proportional to its length. As attention is drawn to both these characters in the original description of *lobaticeps*, this name must be used for the *Saemundssonia* from *Chlidonias nigra*.

No specimens have been seen from the type host of *pustuliferus*, but it is probable that the *Saemundssonia* from this host would be conspecific with that from *C. n. nigra*. *S. pustulifera* is therefore placed provisionally as a synonym of *lobaticeps*.

The history of the name *laricola* has been discussed above, and it is accepted as the name for the species of *Saemundssonia* from *Chlidonias h. hybrida*. Specimens from this host appear to be conspecific with *lobaticeps; laricola* is therefore placed as a synonym of this latter name.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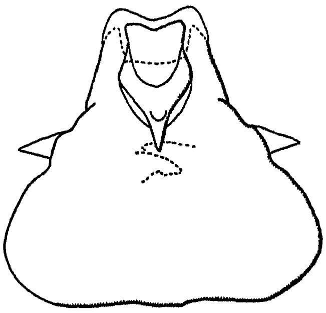
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FIG. 14. *Saemundssonia lobaticeps*, head, male.
FIG. 15. *Saemundssonia hopkinsi*, head, male.

MALE: Head (fig. 14) with general characters as in *sternae*, but distinguished from all preceding species by the emarginated hyaline margin of the head and by the clypeal signature which is deeply emarginated anteriorly and scarcely projects beyond the anterior point of the marginal bands.

Thorax as in *sternae*.

Abdomen with general characters as in *sternae*, but is distinguished by having both the tergal plates and secondary sclerotization of segment II separated medianly. Segments II–IV tend to have a greater number of dorsal setae (see table 2).

Genitalia (figs. 20, 30, 31) are distinguished from those of the preceding species by the presence of a sclerotized cross bar at the distal end of the basal plate and by the median fusion of the endomeral projections.

FEMALE: Head and thorax with characters as in male but larger.

Abdomen with general characters as in *sternae;* tergites and secondary sclerotization of segment II separated medianly. Sternite VII and subgenital plate as in *laticaudatus* (fig. 12); last sternites more elongate (fig. 9). Chaetotaxy as in *sternae,* but dorsal setae are more numerous (table 2), and there are five to seven setae instead of three each side of the last sternite.

TABLE 2

DORSAL ABDOMINAL CHAETOTAXY[a]

	Male	Female
II	8–10	8–10
III	9–14	12–18
IV	13–15	16–18
V	11–13	14
VI	6–8	14–16
VII	5–6	10–14
VIII	4	4
IX–X	4	4

[a] Specimens from *Chlidonias h. hybrida* included.

MATERIAL FROM TYPE HOST EXAMINED: Three males and two females from *Chlidonias n. nigra* (Linné) from Wales, north Greece, and no locality (Piaget collection).

OTHER MATERIAL EXAMINED: Four males and three females from *Chlidonias h. hybrida* (Pallas), Khartoum, Sudan; one male and one female from *Chlidonias hybrida indica* (Stephens), Afghanistan; 16 males and 22 females from *Chlidonias leucoptera* Temminck, Egypt, Sudan, Uganda, and Kenya.

TYPE MATERIAL: Neotype (male) of *S. lobaticeps* (Giebel), slide No. 14035 in the Meinertzhagen collection, from *Chlidonias n. nigra,* south Wales Neoparatypes: Two males and two females from the same host species, localities as listed above.

Neotype (male) and neallotype (female) (agreeing with descriptions and figures of *lobaticeps*) of *S. laricola* (Nitzsch), slides No. 311 and 312 in the British Museum collection, from *Chlidonias h. hybrida* (Pallas), Khartoum, Sudan.

There are four slides labeled *Docophorus lobaticeps* (see Piaget, 1880, p. 110). In the Leiden portion of the Piaget collection there is one male *Saemundssonia* (not examined critically) from *Sterna* *hirundo*. In the British Museum Piaget collection are one male, one female, and one nymph of *S. laticaudata* (Rudow) (slide No. 965) from *Sterna gracilis* = *S. dougallii gracilis* Gould (host record not reliable); one male and one nymph of *S. sternae* (slide No. 964) from *Sterna hirundo;* and one male and one female of *S. sternae* (slide No. 966) from *Sterna* sp. Piaget described and figured (1880, p. 110, pl. 9, fig. 6) *Docophorus laricola* Nitzsch, giving as hosts: *Sterna minuta* = *Sterna albifrons*, *Sterna nigra* = *Chlidonias n. nigra*, and *Sterna hirundo*. The figure shows the emarginated hyaline margin of the head characteristic of this species. The Leiden collection contains three slides labeled *D. laricola* (not examined critically): one male, one female, and one nymph (slide No. 66) and one male and two nymphs (slide No. 67) of *Saemundssonia* from *Sterna minuta;* and one male of *Saemundssonia* (slide No. 68) from *Sterna nigra*. In the British Museum collection there are four slides labeled *D. laricola:* three females of *Saemundssonia* sp.? (slides Nos. 904, 905) from *Sterna minuta;* one male and one female of *S. lobaticeps* from *Sterna nigra* (slide No. 906); one male *S. lobaticeps* from *S. hirundo* (slide No. 908); and one male and one female of *S. sternae* from *S. hirundo* (slide No. 907).

Saemundssonia hopkinsi, new species

Figures 10, 13, 15, 21

This species is nearest *lobaticeps*, from which it is distinguished in both sexes by the clypeal signature; in the male by the characters of the head of the paramere, and in the female by the breadth at the temples (specimens of *lobaticeps* and *hopkinsi* will probably be found showing an overlap in this measurement), the characters of the genital plate, and by the smaller number of setae lateral to the last sternite.

MALE: Head (fig. 15) resembles that of *lobaticeps* in the characters of the emarginated anterior hyaline margin and in the position of the anterior margin of the clypeal signature. It is distinguished by the shape of the signature and by the greater breadth at temples, both actually and proportionally to length of head (tables 4–6).

Thorax as in *lobaticeps* but tends to have more marginal pterothoracic setae (10–12 each side).

Abdomen as in *lobaticeps* but the dorsal setae are more numerous (see table 3).

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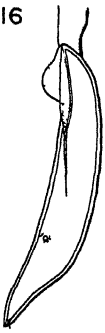

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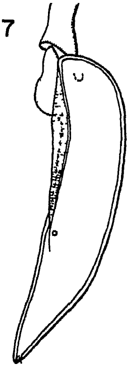

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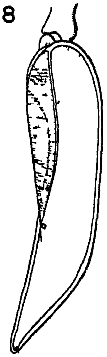

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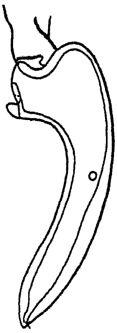

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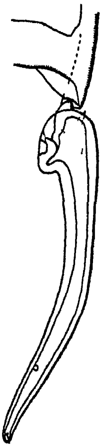


Fig. 16. *Saemundssonia sternae*, parameres.
Fig. 17. *Saemundssonia lockleyi*, parameres.
Fig. 18. *Saemundssonia laticaudata*, parameres.
Fig. 19. *Saemundssonia melanocephalus*, parameres.
Fig. 20. *Saemundssonia lobaticeps*, parameres.
Fig. 21. *Saemundssonia hopkinsi*, parameres.

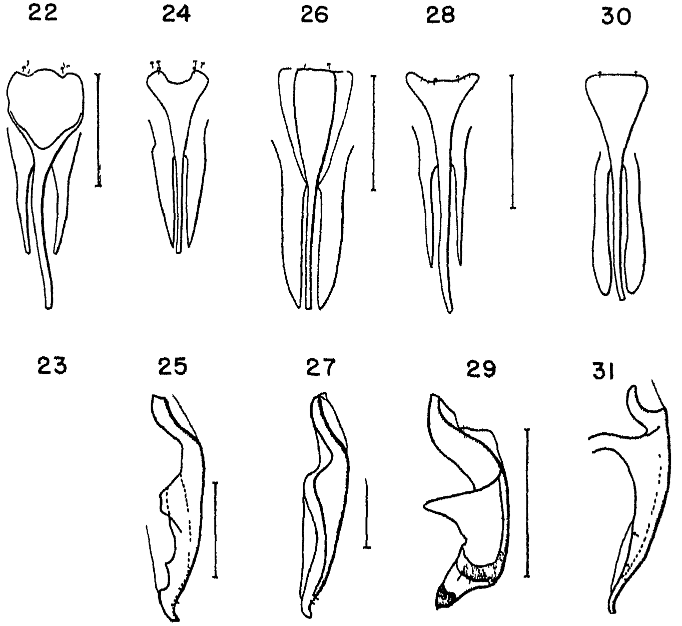
Genitalia of the same type as *lobaticeps* but the parameres are longer and the details of the head different (fig. 21); endomeres and mesosome as in *lobaticeps* but stouter in form.

TABLE 3

DORSAL ABDOMINAL CHAETOTAXY

	Male	Female
II	10-14	10-16
III	16-20	18-22
IV	18-20	18-26
V	14-16	18-22
VI	10-12	20-22
VII	6-8	14-18
VIII	4	6-8
IX-X	2-4	4

FEMALE: General characters of head and thorax as in male, but all measurements greater. The females cannot be distinguished from *lobaticeps* by the proportions of the head.



FIGS. 22, 23. *Saemundssonia sternae*, mesosomal parts of male genitalia.
FIGS. 24, 25. *Saemundssonia lockleyi*, mesosomal parts of male genitalia.
FIGS. 26, 27. *Saemundssonia laticaudata*, mesosomal parts of male genitalia.
FIGS. 28, 29. *Saemundssonia melanocephalus*, mesosomal parts of male genitalia.
FIGS. 30, 31. *Saemundssonia lobaticeps*, mesosomal parts of male genitalia.
Lines represent 0.05 mm.

TABLE 4

Measurements of Types

Male

	Length					Breadth				
	A	B	C	D	E	A	B	C	D	E
Head	0.57	0.55	0.67	0.58	0.60	0.53	0.52	0.63	0.59	0.65
Prothorax	0.14	0.12	0.19	0.14	0.16	0.28	0.28	0.35	0.31	0.33
Pterothorax	0.19	0.18	0.21	0.17	0.21	0.40	0.38	0.48	0.43	0.46
Abdomen	0.67	0.75	1.02	0.62	0.77	0.62	0.61	0.86	0.67	0.73
Total	1.40	1.47	1.88	1.45	1.59					
Paramere[a]	0.25	0.18	0.29	0.23	0.29					

Female

	Length					Breadth				
	A	B	C[b]	D	E	A	B	C[b]	D	E
Head	0.64	0.58	0.71	0.62	0.63	0.65	0.58	0.70	0.67	0.72
Prothorax	0.17	0.15	0.20	0.19	0.16	0.35	0.32	0.37	0.35	0.36
Pterothorax	0.25	0.24	0.23	0.26	0.24	0.50	0.45	0.56	0.50	0.51
Abdomen	1.12	1.03	1.24	0.99	0.89	0.90	0.80	1.01	0.84	0.87
Total	2.00	1.81	2.18	1.86	1.76					
St. VII (mid-line)	0.09	0.11	0.08	0.09	0.07					

A, *sternae;* B, *melanocephalus;* C, *laticaudata;* D, *lobaticeps* (female is not the type); E, *hopkinsi* (female is not the type).

[a] Length from dorsal view.

[b] Specimen slightly distorted.

TABLE 5

Cephalic Index

	No. of Specimens		C.I. Range	
	Male	Female	Male	Female
sternae	12	20	0.90–0.94	0.97–1.05
lockleyi				
(a)	2	6	0.92–0.95	0.92–0.98
(b)	5	11	0.92–0.95	0.93–0.99
melanocephalus	18	18	0.88–0.96	0.94–1.00
laticaudata				
(c)	3	5	0.93–0.95	0.92–0.96
(f)	3	8	0.91–0.95	0.93–1.00
lobaticeps				
(i)	3	2	0.97–1.02	1.08–1.11
(j)	4	3	0.99–1.03	1.08–1.10
(l)	4	11	0.96–1.00	1.05–1.12
hopkinsi	15	15	1.06–1.11	1.10–1.17

See table 6 for list of hosts.

TABLE 6

BREADTH (IN MILLIMETERS) OF HEAD AT TEMPLES OF MALES, IN NUMBERS OF SPECIMENS

	.49	.50	.51	.52	.53	.54	.55	.56	.57	.58	.59	.60	.61	.62	.63	.64	.65	.66	.67	.68	.69
sternae		1		2	1	4	6	5	1												
lockleyi																					
(a)								1		1											
(b)						1	3	3	4	1											
Totals						1	3	4	4	2											
melanocephalus	4	5	2	11																	
laticaudata																					
(c)								1				1				1					
(d)										1	1	3		1							
(e)										1		1									
(f)												2	1	4	3	1					
(g)[a]											2	1	1	1		1					
(h)[a]											1										
Totals								1		2	4	8	2	6	3	3					
lobaticeps																					
(i)									1	1	1										
(j)										1	2			1							
(k)												1									
(l)									4	3	3	4	1								
Totals									5	5	6	5	1	1							
hopkinsi																	5	2	3	3	2

(a) *S. vittata georgiae*
(b) *S. v. bethunei*
(c) *Thalasseus s. sandvicensis*
(d) *T. benghalensis par*
(e) *T. b. bergi*
(f) *T. b. velox*
(g) *T. m. maximus*
(h) *T. eurygnatha*
(i) *Chlidonias n. nigra*
(j) *C. h. hybrida*
(k) *C. h. indica*
(l) *C. leucoptera*

TABLE 7

BREADTH (IN MILLIMETERS) OF HEAD AT TEMPLES OF FEMALES, IN NUMBERS OF SPECIMENS

	.55	.56	.57	58	.59	.60	.61	.62	.63	.64	.65	.66	.67	.68	.69	.70	.71	72	.73	.74	.75	.76
sternae								2	2	3	3	4	5									
lockleyi																						
(a)					1	1			2	1	1											
(b)						2	1	4	2	3	2											
Totals					1	3	1	4	4	4	3											
melanocephalus	5	2	7	1	5																	
lacticaudata																						
(c)										2	2		1			1						
(d)														1								
(f)											1		2	3	1	1						
(g)[a]													2		1							
Totals										2	3		5	4	2	2						
lobaticeps																						
(i)													1			1						
(j)														1		1		1				
(k)																1						
(l)												1	5	3	1	2						
Totals												1	6	4	1	5		1				
hopkinsi																		2	1	4	4	3

See table 6 for list of hosts.

[a] Not *laticaudata*, *sensu stricto*.

Abdomen as in *lobaticeps*. General characters of sternite VII and subgenital plate as in *lobaticeps*, but sternite VII is narrower medianly and strongly arched (fig. 13). Last sternal plate may prove to be diagnostic in general form (fig. 10); setae lateral to this plate three to four each side. Setae tend to be more numerous than in male (table 3).

Described from 15 males, and 17 females from *Sterna aurantia* J. E. Gray from Deccan and Nepal, India, and Myitkyina, Burma.

Holotype (male), slide No. 8730 in the Meinertzhagen collection, from *Sterna aurantia* Gray, Deccan, India. Paratypes: Fourteen males and 17 females from the same host species, localities as listed above. No allotype has been designated, as the only female in good condition from the Indian specimens is deformed, tergite V and VI on one side being partially fused. The Burmese material was examined shortly before going to press after the figures and measurements had been made. This latter material was seen through the kindness of Dr. Henry S. Fuller of the Bowman Gray School of Medicine, Winston-Salem, North Carolina.

The species is named in honor of Mr. G. H. E. Hopkins, to whom I am greatly indebted for the loan of some notes on the nomenclature of these species and for further advice on the same subject.

Saemundssonia atlantica (Kellogg), 1914

Docophorus atlanticus Kellogg, 1914, p. 81. Hosts: *Stercorarius crepidatus* = *S. parasiticus* (Linné) and *Sterna paradisea* Pontoppidan.

This species must be mentioned, as it was described from material alleged to have been collected from *Stercorarius parasiticus* and *Sterna paradisea*, and as Harrison (1916, p. 88) gives only the second host. The species of *Saemundssonia* on these two hosts are quite distinct, and there is no doubt that the figure represents the type of *Saemundssonia* found on *Stercorarius* and not that on *Sterna*. The record on the latter host must therefore be due to some error.

SUMMARY

All the known species of *Saemundssonia* from the Sterninae are discussed, and two new species are described. The species of previous authors described from more than one host, and therefore

usually composite, are restricted to one type host and redescribed and figured. Neotypes have been erected for species of which the original type material is presumed to be lost and where material from the type host is available.

LIST OF SPECIES DISCUSSED, WITH TYPE HOSTS
(Synonyms in brackets)

Saemundssonia	
atlantica (Kellogg), 1914....	*Stercorarius parasiticus* (Linné)
hopkinsi, new species	*Sterna aurantia* J. E. Gray
laticaudata (Rudow), 1869........	*Thalasseus s. sandvicensis* (Latham)
[*brevicornis* (Giebel), 1874.......	*Thalasseus s. acuflavidus* (Cabot)]
lobaticeps (Giebel), 1874..........	*Chlidonias n. nigra* (Linné)
[*pustuliferus* (Picaglia), 1885....	*Chlidonias nigra surinamensis* (Gmelin)]
[*laricola* (Giebel), 1874.........	*Chlidonias h. hybrida* (Pallas)]
lockleyi, new species.......... ...	*Sterna vittata georgiae* Reichenow
melanocephalus (Burmeister), 1838.	*Sterna a. albifrons* Pallas
peristica (Kellogg and Kuwana), 1902.........................	*Sterna fuscata crissalis* (Lawrence)
snyderi (Kellogg and Paine), 1910..	*Sterna lunata* Peale
sternae (Linné), 1758....	*Sterna h. hirundo* Linné
[*fornicatus* (Olfers), 1816.......	*Sterna h. hirundo* Linné]
[*5-maculatus* (Piaget), 1885.....	(*Chelidon u. urbica* (Linné)]. In error

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NEW CARIDEA FROM THE DOMINICAN REPUBLIC

By John C. Armstrong

INTRODUCTION

The material upon which this report is based was collected by the author at Barahona Harbor, Dominican Republic, during the summers of 1932 and 1933. A narrative account of this work by William G. Hassler has appeared in Natural History (1933, vol. 33, no. 3, May-June, p. 287). The local names referred to in the text may be found on the United States Hydrographic Office charts of the region.

My thanks are due to Dr. Fenner A. Chace, Jr., for the privilege of examining specimens of *Crangon viridari* and of *C. armillatus* in the Museum of Comparative Zoology and to Dr. Waldo L. Schmitt for making available to me material of these two species from the collection of the United States National Museum.

HIPPOLYTIDAE

GENUS **OGYRIDES** STEBBING

In his great monograph on the family Crangonidae, Coutière (1899) considered *Ogyrides* to be a member of that group, and most subsequent workers have followed him in this. The relation of this genus with more typical crangonids was thought to lie through *Automate* and *Pterocaris.* Of this he wrote (*ibid.*, pp. 347–348), "La série *Ogyris* [*Ogyrides*], *Pterocaris, Automate* se laisse assez nettement établir. Ces genres offrent le caractère commun des ophthalmopodes parallèles, cylindriques, non recoverts par la carapace échancrée. *Ogyris* est à beaucoup d'égards (absence d'échancrures cardiques, armature du telson, rostre multidenté, 1re paire faible, méropodite de la 3me paire armé) un véritable Hippolytidé, et constitute le point de contact le plus étroit de cette famille avec les Alpheides [Crangonidae]."

At that time he had not, however, seen any examples of *Ogyrides, Automate,* or *Pterocaris.* Ortmann, who had described *O. occidentalis* under the family Hippolytidae in 1893, adhered to his original classification in 1901. The most drastic revision was that proposed by Hay and Shore (1918) who wrote (p. 388), "Having before us representatives of *Ogyris* (*Ogyrides*) and *Automate,* as well as several typical genera of both families mentioned (Crangonidae and Hippolytidae), we have come to the conclusion that *Ogyris* differs too greatly and in too many characters to admit to our placing it in either family. Its resemblance to *Automate* is very slight, and it appears also to be very different from *Pterocaris.*" They, therefore, proposed that a special family, Ogyridae, should be erected for its reception. Of this they said, "The family is coterminous with the genus *Ogyris* and, probably, should stand between the Crangonidae and the Hippolytidae."

Their suggestion has not been followed by later authors. The general agreement that the Crangonidae and Hippolytidae are very closely related and that *Ogyrides* stands, as it were, in the position of connecting link cannot be retained if we are to accept the conclusions which Gurney based upon extensive studies of decapod larvae. In his report (Gurney, 1938) on the palaemonid and crangonid larvae of the Red Sea he follows a discussion of the larval characters of the families involved with the statement (p. 59), "The points of similarity which I have given are at least positive and unequivocal, and I submit that they suffice to prove that the Palaemonidae and the Alpheidae [Crangonidae] are very closely related, and that they are not nearly related to the Hippolytidae."

A comparison between the series of *Ogyrides yaquiensis* before me and two species of *Automate, kingsleyi* and *haightae,* shows little similarity between these genera. With the exception of the relatively very slight elongation of the eyestalks in *Automate,* that genus does not appear to resemble *Ogyrides* any more closely than do the other crangonid genera. The more important divergences between *Ogyrides* and the described genera of the crangoids are: (1) the strong bristles and narrow proportions of the median and inner laciniae of the first maxillipeds; (2) the third segment of the third maxilliped being shorter than the second; (3) the feeble development of the first pair of chelipeds; (4) the presence of a sternal plate on the thorax; (5) the multidentate rostrum; (6) the transverse ridges and grooves of the telson; (7) the absence of the cardiac notch; and (8) the absence of the transverse articulations of the outer blades of the uropods. Among the known genera of the crangonids these last two characters are similar only in the genus *Thunor*, a highly specialized relative of *Crangon* which quite obviously bears no special affinity to *Ogyrides*. Considering also that if *Ogyrides* be excluded, the family Crangonidae forms a very compact group of closely related genera, I do not believe that the available evidence justifies its inclusion in that group. Among the other caridean families, it appears to be most closely related to the Hippolytidae. The following characters support this relation: (1) the multidentate rostrum; (2) the absence of the cardiac notch; (3) the feeble development of the first pair of chelipeds; (4) the multi-articulate carpus of the second leg; and (5) the presence of a thoracic sternal plate. Ventral processes on the thoracic sterni are found on a number of hippolytids. I have observed them on species of *Spirontocaris*, *Alope*, *Saron*, *Thor*, and *Trachycaris*, those of the latter genus being particularly well developed. In this family they may also occur on both sexes.

So far as I have been able to ascertain, no genus previously referred to the Hippolytidae has the terminal segment of the third maxilliped shorter than the penultimate as does *Ogyrides*, nor does any have the transverse grooves and ridges of the telson.

In the synoptic key to the genera of Hippolytidae, given by Holthuis (1947, p. 4) in his recent review of the family, *Ogyrides* would fall close to *Enalus*. It does not, however, bear any striking resemblance to that genus.

In conclusion, I consider that *Ogyrides* is best accommodated in the Hippolytidae for the present and that a knowledge of the larval stages must be obtained before the question of its relationships can be satisfactorily resolved.

Ogyrides yaquiensis, new species

Figure 1

MATERIAL: Holotype, one female, A.M.N.H. No. 9564, carapace 4.3 mm. long; paratypes, 27 females (16 ovigerous), eight males, and nine so mutilated that the sex cannot be determined, A.M.N.H. No. 9565. All taken on grass banks 1 to 3 feet deep near mouth of Rio Yaqui del Sur.

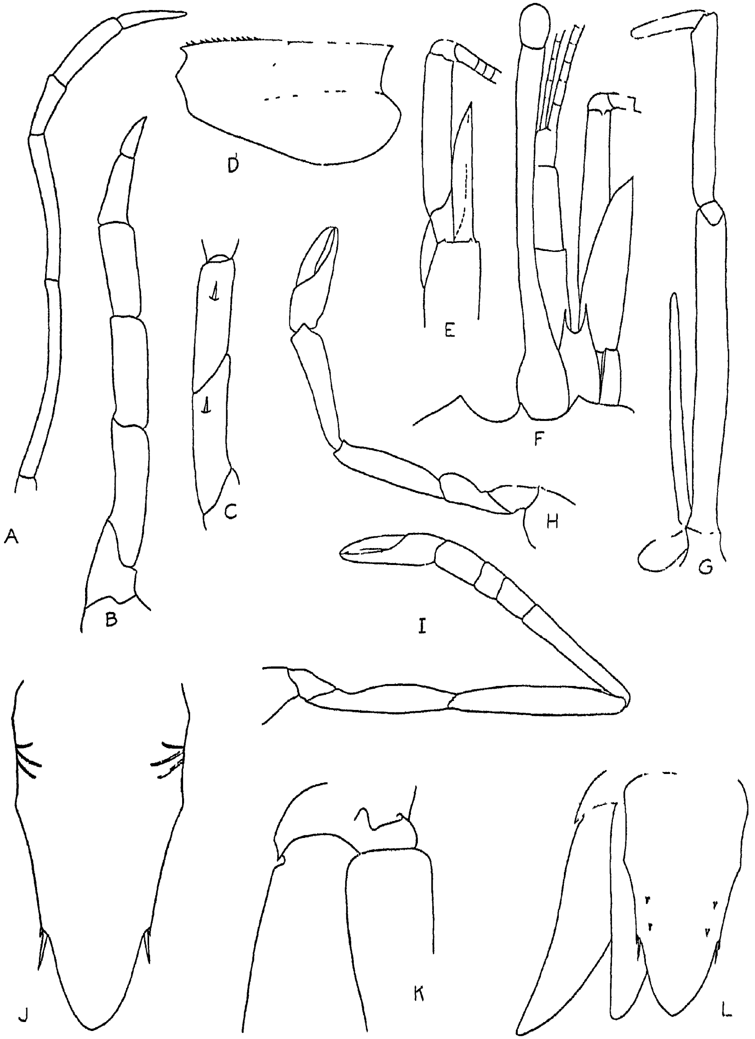

FIG. 1. *Ogyrides yaquiensis*, new species. A. Fifth leg. B. Third leg, outer side. C. Ischium and merus of third leg, inner side. D. Carapace. E. Peduncle of second antenna. F. Frontal and antennal structures. G. Third maxilliped. H. First cheliped. I. Second cheliped. J. Under side of telson. K. Under side of proximal portion of uropod. L. Tail fan.

DESCRIPTION: The rostrum is equilaterally triangular, curving downward slightly at the tip which is rounded and furnished with a scanty tuft of coarse bristles. The anterior margin of the carapace is fringed with short fine hairs. The rostral carina is low, extends one-quarter the length of the carapace and bears from eight to 12 spiniform teeth. (The frequency distribution of these teeth is shown in table 1.) The carina with the fewer teeth have, in general, the longer teeth. Coarse bristles similar to those at the tip of the rostrum are placed in a row at either side of these teeth along about half the length of the carina.

The eyestalks, narrowest in the middle, extend beyond the carpocerite for from 0.24 to 0.38 of their length. The proximal third of their interior border is beset with a few short plumose bristles.

The antennular peduncle falls slightly short of the carpocerite. The second antennular article is a little more than half as long as the first; the third, a little less than half the second. The stylocerite is large, reaching slightly less than two-thirds the length of the first antennular article and terminates in two strong, acuminate spines.

Both the internal and external distal angles of the ventral surface of the basicerite are armed with a minute spine. The scaphocerite reaches nearly to the end of the second antennular article. Its scale, nearly four times as long as wide at its greatest width, is almost as long as the lateral spine, only a minute tip of the latter being left free. The carpocerite exceeds the scaphocerite by one-third of its length and is five times as long as wide.

The third maxillipeds are long, reaching beyond the eye peduncles when extended.

The first pair of chelae are short, feeble, and symmetrical. The fingers, with pointed tips, gape slightly when closed, have unarmed cutting edges, and are somewhat less than twice the length of the palm. The merus is four times as long as wide.

The second pair over-reaches the carpocerite by about half the length of the fingers. The carpus is subdivided into four segments which stand in the following proportions on the type: proximal 1.0: second 0.27: third 0.18: fourth 0.31: and chela 0.82. On the figured specimen these ratios are: 1.0:0.27:0.18:0.35:0.73; on another specimen: 1.0:0.30:0.16:0.30:0.80.

All the segments of the following three pairs of legs are furnished with setae. The ratios of the lengths of five distal segments of the third leg of the type are: ischium 1.0: merus 0.9: carpus 0.8:

propodus 0.54:dactylus 0.28. On the figured specimen these ratios are: 1.0:0.70:0.68:0.47:0.33; on another female: 1.0: 0.91:0.73:0.45:0.36. The merus and the ischium of the third leg are armed with strong spines near the distal end of the inner side. The lengths of segments of the fourth leg of the type stand in the ratios: ischium 1.0:merus 1.14:carpus 0.68:propodus 0.50: dactylus 0.21.

The relative lengths of the ischium, merus, carpus, propodus, and dactylus of the fifth leg of the type are: 1.0:0.7:0.29:0.40: 0.35; on the figured specimen: 1.0:0.72:0.29:0.44:0.35; on another female: 1.0:0.67:0.24:0.36:0.27.

The telson has an obtuse lateral prominence situated at about the proximal third of the lateral margins. The distal end is obtusely pointed. The ventral surface bears three arcuate transverse ridges on either side near the proximal base.

REMARKS: *Ogyrides yaquiensis* resembles *occidentalis* (Ortmann) and *striaticauda* Kemp. *Yaquiensis* may be at once distinguished from *occidentalis* by the great length of the eyestalks, which over-reach the antennular peduncle by from one-quarter to one-third of the length of the eyestalks on *yaquiensis* and reach about to the end of the antennular peduncle on *occidentalis*. According to Ortmann's figures (1893, pl. 3, figs. 4–4n) of *occidentalis*, *yaquiensis* also differs in the following particulars: (1) the external angle of the basicerite of *yaquiensis* bears a very minute spine discernible only under high magnification, while *occidentalis* bears a strong spine at that point; (2) the scaphocerite of *yaquiensis* is shorter and has a less prominent lateral spine; (3) the lateral prominences of the telson are well developed in *yaquiensis* and lacking in *occidentalis*. From *striaticauda*, *yaquiensis* may be distinguished by the following characters: (1) the longer ocular peduncles which in *striaticauda* exceed the antennular peduncle by only the length of the last segment; (2) the relative length of the carpal segments of the second leg, of which the third is only about one-half the length of the second and fourth in *yaquiensis* and the last three of which are subequal in *striaticauda;* (3) the number of transverse ridges on the under side of the telson, three in *yaquiensis* and four in *striaticauda*.

Hay and Shore (1918, p. 388) and Yokoya (1927, p. 172, pl. 7, fig. 14) refer to the sternal plate as a thelycum. These authors had only single specimens for study, in both cases females. Kemp (1915, p. 288, fig. 30d), although dealing with series of specimens, does not give the sexual distribution of that structure but refers to it as a sternal plate. In *yaquiensis* this plate is present on the males as well as the females and cannot therefore be regarded as a thelycum. Its shape and size in the three other species for which this character is known, *alphirostris* (Kingsley), *occidentalis* (Ortmann), *orientalis* (Stimpson), as described by Yokoya (1927, p. 172), and *striaticauda* (Kemp), seem to be much the same as in the present species.

The transverse ridges on the under side of the telson appear to have been overlooked by all authors except Kemp (1915) and De Man (1922). On these Kemp (*ibid.*, p. 288) remarked, "The telson does not possess a feeble lateral prominence but on either side, situated in the proximal third on the ventral surface, are four oblique ridges, the three anterior ones placed close together, the other rather more distant. In spirit they have a rather nacreous lustre and perhaps represent a stridulating organ, but I am unable to find that they possess transverse striae and there does not appear to be any ridge on the basal segment of the uropods which could be brought to bear on them...." I have also observed three such ridges on the telson of *occidentalis* and of *alphirostris*.

In *Ogyrides yaquiensis* the structure on the under side of the telson consists of three short arcuate ridges near its proximal base. These extend to the margins of the telson and, if the telson be examined from a lateral view, they are clearly visible in the emargination defined by the proximal base of the telson and the lateral prominences. When viewed in this manner, the ridges may be seen to incline posteriorly at a considerable angle from the normal to the ventral surface of the telson. On the basal segment of the uropods is a structure which locks with these ridges. This structure consists of a ridge whose anterior edge is undercut to form a groove receiving the telson ridge and which curves in a complementary sense to the telson ridge. The external and internal ends of the uropod ridge terminate in an obtuse tooth or lobe, that of the outer end being much the larger. Both of these are directed anteriorly.

In those preserved specimens on which this mechanism remained engaged, the transverse portion of the uropod ridge was hooked upon one of those of the telson, while the outer lobe comes to rest against the lateral margins of the telson. These margins are beveled towards the dorsal surface of the telson, and part of the outer lobe of the uropod ridge engages with that portion of the telson ridge which lies on that slope of the bevel. Most of the specimens with the ridges interlocking in the preserved material had the uropod ridge hooked over the second telson ridge; a few, however, had it engaged with the first or the third. How this is possible may be seen by the following experiment: If the telson of a well-preserved specimen with the anterior ridge engaged be depressed by pressing on its dorsal surface while holding the abdomen stationary, the relative positions of the uropods and telson will be altered; any point on the uropods will be brought opposite a point on the telson posterior to that which is formerly opposed. Consequently, provided the muscles of the uropods in this preserved material remain firm enough to offer some resistance to the movement of the telson, the result of this procedure is to cause the ridge on the uropod to engage with a telson ridge posterior to the one with which it was formerly associated. If the pressure on the telson now be released, the telson will remain locked in this new position.

TABLE 1

Teeth on Rostral Carina in *Ogyrides yaquiensis*, New Species

Number of specimens	1	4	34	5	2
Number of teeth	8	9	10	11	12

It may thus be seen that the morphology of this curious structure suggests the possibility that it may serve as a locking mechanism to strengthen the tail fan when used as an oar for the rapid backward propulsion of the animal. The transverse ridges would then serve to keep the tail fan together in a dorso-ventral sense, while the inner spur on the uropod ridge may help to prevent a lateral displacement of the uropods. What utility there may be in having a series of transverse ridges on the telson, with the resultant possibility of locking the telson in as many positions, is not evident, and I cannot at present offer any suggestion.

CRANGONIDAE

GENUS **CRANGON** WEBER

Crangon viridari, new species

Figure 2

Crangon armillatus Darby (not Milne Edwards), 1934, p. 349; 1935, p. 151; 1939, p. 61.

MATERIAL: Holotype, one male, carapace length 120 mm., A.M.N.H. No. 9567; paratypes: dissected specimen, one male, A.M.N.H. No. 9569, carapace length 112 mm.; 41, A.M.N.H. No. 9568. This species was very common on the grass banks inside the north end of El Cayo where 43 specimens were obtained by sweeping with a dip net.

DESCRIPTION: The rostrum is narrow, 1.7 times as long as wide on the type, 2.0 on the dissected specimen, 1.8 on another, and 2.2 on yet another. The rounded rostral carina is defined by shallow sulci and extends back on the carapace to the base of the orbital hoods.

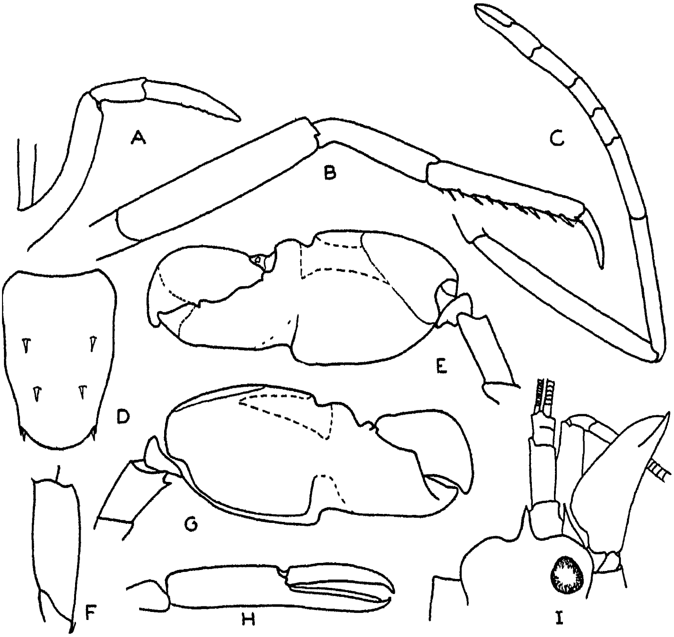

FIG. 2. *Crangon viridari*, new species. A. Third maxilliped. B. Third leg. C. Second leg. D. Telson. E. Large chela, lower side. F. Merus of small chela. G. Large chela, upper side. H. Small chela. I. Frontal and antennal structures.

The lengths of the first, second, and third antennular articles on the dissected specimen stand in the following ratio: 2.4:2.0:1.0; and on another specimen: 2.5:1.95:1.0. The second antennular article is 2.5 times as long as wide at the middle and 2.1 times as long as wide at the distal end as the dissected specimen. These figures were 2.5 and 2.0, respectively, on another specimen. The terminal spine of the scaphocerite reaches to the end of the first antennular segment. The basicerite, unarmed above, bears a strong ventral spine. The carpocerite, 4.25 times as long as wide on the dissected specimen and 4.0 times as long as wide on another, reaches to the end of the antennular peduncle. The scale of the scaphocerite, 2.6 times as long as its greatest width on the dissected specimen, reaches to the end of the carpocerite with its terminal spine projecting slightly farther.

The distal end of inner margin of the upper side of the merus of the larger chela bears a strong spine. The proportions of the larger chela of the type are: total length 1.0: fingers 0.35: height 0.46; on the dissected specimen these ratios are: 1.0:0.38:0.44; on another specimen: 1.0:0.37:0.43. The fixed finger has a small, V-shaped notch in the cutting edge at about the mid-point of its length. The merus of the smaller chela is armed with a small acute spine at the distal end of the inner margin of the upper side. The small chela ranges from 5.0 to 6.2 times as long as wide, being broader on the smaller specimens and on the males of pairs of approximately equal size (table 2). The dactyl is simple in both sexes.

The merus of the second pair of chelae is 8.3 times as long as wide on the dissected specimen. The lengths of the proximal, second, third, fourth, and distal carpal segments of the dissected specimen stand in the following proportion: 1.0:0.61:0.25:0.28: 0.36; on another specimen: 1.0:0.63:0.26:0.24:0.37; and on yet another: 1.0:0.6:0.3:0.3:0.4.

The merus of the third and following legs is unarmed. On the dissected specimen this is 5.3 times as long as wide, on another specimen 5.2, and on yet another 4.9. The dactyls of the third and following legs are simple.

The telson of the dissected specimens is 2.6 times as long as wide at the distal base, that of another specimen 2.5.

DISCUSSION: *Crangon viridari* appears to resemble *C. armillatus* (H. Milne Edwards) most closely. From that species it may be separated by the following characters. The rostral carina in *viridari* is straight and rounded, that of *armillatus* is usually flat and either triangular or U-shaped. There is a complete intergradation of these shapes in the latter species, and as the proportions of the chelae cited by Schmitt (1924, p. 77) also show an almost perfect gradation, *Crangon verrilli*, established by him for specimens with a U-shaped rostral area, must be considered identical with *C. armillatus.* I have also seen specimens of the latter species which permit the selection of a graded series leading to a very rare extreme where the rostral area has been reduced to a rounded carina as in *C. viridari.*

TABLE 2

Crangon viridari		*Crangon armillatus*	
Length of Carapace (in mm.)	Length/Width of Small Chela	Length of Carapace (in mm.)	Length/Width of Small Chela
42	5.0	60	3.4
45	5.0	65	4.5
55	5.0	70	4.0
55	5.3	72	4.1
60	5.0	75	3.5
60	5.3	85	4.1
60	5.6	90	4.2
75	5.5	90	3.7
75	5.5	90	3.5
78	5.0	95	3.7
79	5.0	100	4.0
85	5.3	100	5.0
85	5.0	105	4.3
90	5.3	107	4.1
90	5.3	110	3.9
90	5.5	110	3.5
105	5.5	110	3.6
105	5.5	110	3.0
110	5.3	115	3.2
110	5.5	115	3.7
120	5.4	120	2.9
125	5.5	120	4.1
125	5.5	120	3.6
130	5.5	125	3.5
130	6.2	130	3.3
		130	4.4
		135	3.1
		140	3.5
		140	3.6
Mean carapace length 87.36 Mean length/width of small chela 5.34 Standard deviation of length/width of small chela 0.27		Mean carapace length 104.62 Mean length/width of small chela 3.8 Standard deviation of length/width of small chela 0.47	

The notch on the cutting edge of the fixed finger of the large chela is perhaps the most convenient diagnostic feature; this is always present in *viridari* and absent in *armillatus*.

The smaller chela of *viridari* is significantly narrower than that of *armillatus* (table 2). The critical ratio of the difference between the means is 15.75, indicating that there is only about one chance in several hundred thousand that such a difference could have arisen from chance alone.

With *viridari* there is positive correlation between the length of carapace and the ratio of the length to width of the small chela. The correlation coefficient is +0.6, indicating a significant tendency for the claw to become narrower as the length of the carapace increases. For *armillatus* the corresponding correlation coefficient is −0.3 showing a slight tendency for the claw to become wider with increasing carapace length.

The abdominal sternites of *viridari* are always unarmed, while about 60 per cent of males and 25 per cent of the females of *armillatus* have a median spine on at least the first of these sternites.

It is also interesting that these two forms seem to be separated by an ecological isolation. *C. viridari* has been taken only upon grass banks, while as far as I am aware *C. armillatus* is found only among and under stones. The "*C. armillatus*" discussed by Darby (1934, 1935, 1939) as living on the grass banks at Tortugas, Florida, proved upon examination of the material deposited by him in the United States National Museum to be *C. viridari*.

THUNOR, NEW GENUS

Rostrum absent. Front emarginate. Orbital hoods rounded, unarmed, and covering the eyes anteriorly. Cardiac notch absent. Carapace lacking all spines.

Ocular beak absent. Corneae unarmed.

Terminal segment of antennular peduncle bifurcated.

Mouth parts of *Crangon* with the exception of the first maxilla which lacks the setae on the outer half of the bifurcated palp.

First chelae directed anteriorly and very asymmetrical. Larger chela with adhesive disks. Dactylus of larger chela with the pollex as in the *Obesomanus* group of *Crangon*.

Second chelipeds with the carpus divided into five segments.

No transverse articulation on outer uropods.

No anal tubercles.

Branchial formula of *Crangon*.

DISCUSSION: *Thunor* appears to be most closely related to *Crangon*. Among the described secies of *Crangon*, *Thunor rathbunae* most closely resembles *C. idocheles* described by Coutière (1906, p. 883) from the Indian Ocean. From this and all other species of *Crangon*, *Thunor* may be distinguished by the following characters: (1) the obsolescence of the ocular beak, well developed in all species of *Crangon* as a distinct projection; (2) the absence of the cardiac notch, well developed in all other genera of the family; (3) the absence of the anal tubercles; and (4) the absence of the transverse articulations of the outer uropods.

Thunor rathbunae (Schmitt)

Figures 3, 4A–J, 4L

Crangon rathbunae SCHMITT, 1924, p. 74, pl. 1, figs. 1–10.

MATERIAL: Thirty-one females (22 ovigerous) and 42 males

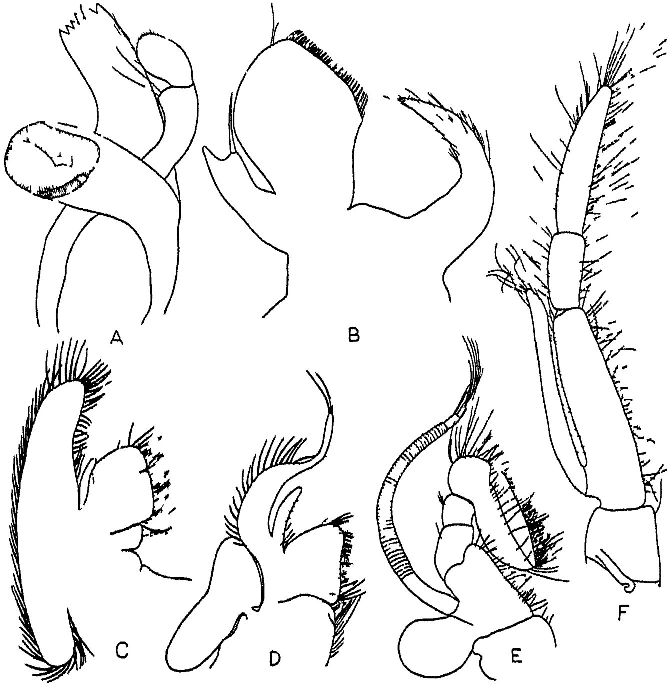

FIG. 3. *Thunor rathbunae* (Schmitt). A. Mandible. B. First maxilla. C. Second maxilla. D. First maxilliped. E. Second maxilliped. F. Third maxilliped.

from the crevices of dead coral fragments in the quiet water behind the Piedra Prieta Reef.

REMARKS: The armature of the telson exhibits a degree of variation which is not, so far as I am aware, equaled by any other species of crangonid. Not only do the number and position of their spines on both the telson and the uropods vary, but their arrangement is often asymmetrical. Typical variations are shown in figure 4. That shown in E of that figure is evidently the "norm" of the Barahona population, as 60 per cent of the specimens presented either that configuration or one very similar to it. That of D is the next commonest, with 16.5 per cent of the specimens having the four dorsal or marginal spines near the distal end and two pairs of terminal spines. The individuality of the specimens is so pronounced that, although most of them resemble

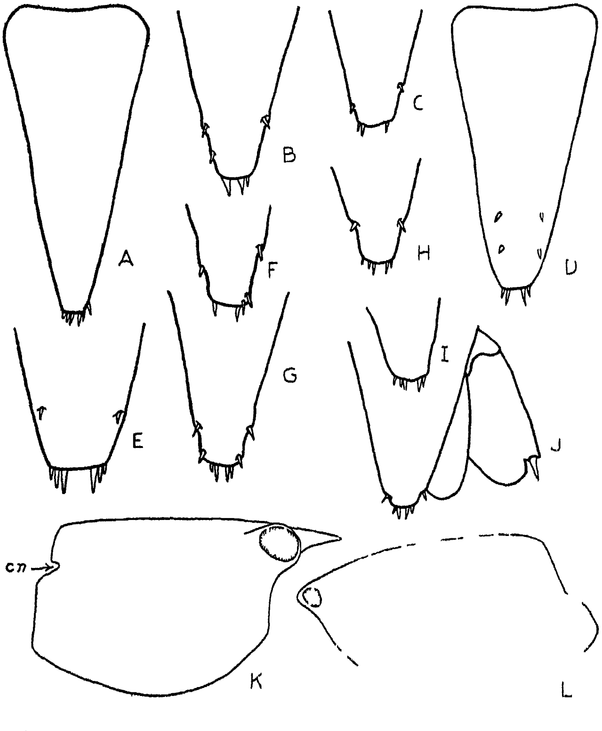

FIG. 4. *Thunor rathbunae* (Schmitt). A–J. Varieties of telsons. K. Carapace of *Crangon gracilipes* showing cardiac notch, c.n. L. Carapace of *Thunor rathbunae.*

one of the figured types, it does not seem possible to group them into any very significant classification. Most of the uropods are quite normal in appearance with a single unpigmented spine on the external distal margin of the outer blade. A few, however, have one or both of the spines duplicated, and some showed the black pigmentation so characteristic of the *Macrochirus* group of the genus *Crangon*.

GENUS SYNALPHEUS

Synalpheus filidigitus, new species

Figure 5

MATERIAL: Holotype, one male, A.M.N.H. No. 9572, carapace length 2.7 mm.; paratypes, A.M.N.H. No. 9573, dissected specimen, one female, A.M.N.H. No. 9574. This species was very common in the cavities of a small sponge growing between the branches of a colony of porites in the quiet water halfway between the Piedra Prieta Reef of Barahona Harbor and the shore; over 150 specimens were collected forming the series discussed below.

DESCRIPTION: The rostrum is short, its length being less than half the distance across the front as measured between the tips of the orbital spines. The latter are subequal to the rostrum in length, being generally a little shorter but occasionally equal to, or even exceeding, it in some specimens.

The length of the first, second, and third articles of the antennules stand in the following ratio on the dissected specimen: 2.0: 1.0: 1.0. The stylocerite reaches about to the distal quarter of the first article.

The superior angle of the basicerite bears a strong spine which falls short of the end of the stylocerite (in the type by an amount about equal to its own length). The slender outer spine reaches in the type to the end of the second antennular article. In other cases it may be a little shorter and hardly reaches to the middle of the same article in some specimens. The scale of the scaphocerite is lacking in both sexes. The spine reaches to the end of the distal antennal article on the type and appears to have a range of variation very similar to that of the outer spine on the basicerite. The carpocerite, five times as long as wide on the dissected specimen, exceeds the antennular peduncle usually by about the length of the terminal antennular article.

The proportions of the larger chela on the type are: fingers 1.0:

total length 3.3:height 1.1; on the dissected specimen these are: 1.0:3.5:1.3; on another specimen: 1.0:2.7:0.9; and on still another: 1.0:3.0:0.9. The palm is armed anteriorly with a small tubercle tipped with short, slender, downwardly directed spine. The great majority of individuals show the form illustrated in figure 5A. In a few cases, however, the tubercle may be reduced until in extreme examples the spine appears to spring merely from a slight prolongation of the palm, the dorsal margin of which is then straight. In a very few the spine itself may be reduced. Two small specimens, a male and a female, with narrow chelae lack the spine, while two small males not only lack the spine but show only a trace of the tubercle.

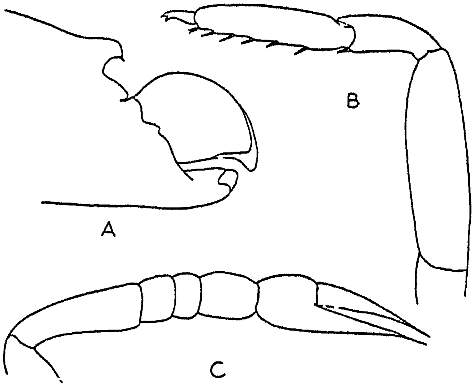

FIG. 5. *Synalpheus filidigitus*, new species. A. Distal portion of large chela. B. Third leg. C. Second leg

The proportions of the smaller chela on the type are: fingers 1.0:total length 2.2:height 0.8; on the dissected specimen these ratios are: 1.0:2.20:0.77; on another specimen: 1.0:2.25:0.83. The carpus is very close to 0.5 of the total length of the chela in all the larger specimens measured but is somewhat longer in the very small individuals, being 0.4 of the total length of the chela on a male with a carapace length of 1.9 mm. The merus is 3.3 times as long as wide on the type, on the dissected specimen 3.6, on another specimen 3.4, and on still another 3.5.

The carpus of the second leg has only four articles. The first, second, third, and fourth of these stand in the following ratio on the dissected specimen: 1.0:0.2:0.16:0.4; on the opposite side of the same specimen: 1.0:0.23:0.18:0.45; on another individual:

1.0:0.27:0.23:0.45. The fingers of the chela are peculiarly elongate, being almost threadlike at their tips.

The merus of the third legs is 3.3 times as long as wide on the type, 3.4 on the dissected specimen, and 3.5 on another specimen.

The outer margins of the uropods bear from four to two teeth, the majority having three.

A large female, carapace length 3 mm., carried 20 eggs 0.6 mm. in diameter.

REMARKS: This form agrees very closely with Coutière's *S. rathbunae*, from which it differs in the following particulars: (1) the superior spine of the basicerite which in *S. filidigitus* constantly falls short of the end of stylocerite and which extends to the end of the latter in *S. rathbunae;* (2) the tubercle on the distal end of the palm of the larger chela which is spinose in the great majority of individuals of *S. filidigitus* and not spinose on *S. rathbunae;* (3) the narrower merus of the smaller chela which is over three times as long as wide on *S. filidigitus* and only 2.35 on *S. rathbunae;* (4) the filiform tips to the fingers on the second chelae of *S. filidigitus* which are of normal shape on *S. rathbunae;* and (5) the narrower merus of the third leg which is over three times as long as wide on *filidigitus* and only 2.8 on *rathbunae.*

The apparent discrepancy in the relative length of the first antennular article, which I have given as twice the second for the *filidigitus* while Coutière (1909, p. 84, fig. 51) indicates that in the *rathbunae* it is only 1.2 times the second, may be due to the method of measurement. I have removed this appendage and measured the length of the first article from its base. From Coutière's figure it seems, however, probable that his ratio refers to the length of the visible portion of the first segment.

Synalpheus disparodigitus, new species

Figure 6

MATERIAL: Holotype, one male, A.M.N.H. No. 9575, carapace 3.8 mm. long; paratypes: eight males, five females (two ovigerous), A.M.N.H. No. 9576; dissected specimen: one male, A.M.N.H. No. 9577. All are from the quiet water behind the Piedra Prieta Reef.

DESCRIPTION: The rostrum is narrow, four times as long as wide on the type and falls short of the end of the first antennular segment by a distance equal to its own length on the type, by 1.15 of its length on the dissected specimen, and 1.65 on a small male.

The orbital, or lateral, spines are wider, as long as wide on the type, and vary in length from being almost equal to the rostrum to being only about one-half as long. On a single female the lateral spine of the left side is completely absent.

The first, second, and third antennular articles on the dissected specimen stand in the following ratio: 2.8:1.73:1.0. The second article is 1.73 times as long as wide at the distal extremity, and the third just as long as wide at the distal end on the dissected specimen. The stylocerite falls short of the end of the first antennular segment by 0.19 of the length of that segment on the dissected specimen.

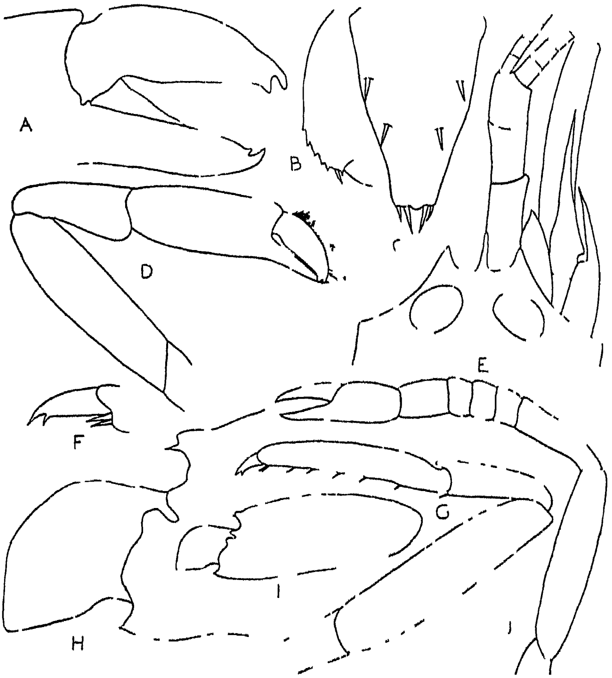

FIG. 6. *Synalpheus disparodigitus*, new species. A. Finger of small chela. B. Outer margin of uropods. C. Telson. D. Small chela. E. Frontal and antennal structures. F. Dactyl of third leg. G. Third leg. H Distal portion of large chela. I. Large chela. J. Second leg.

The basicerite has the upper angle truncate, almost a right angle on the type. Its lateral spine reaches to the end of the first antennular article on the type and to the proximal fourth of that segment on another specimen. The scaphocerite lacks the scale on both sexes. The spine, reaching from 0.5 to 0.75 of the length of the ultimate antennular article, falls short of the end of the carpocerite by 0.33 of its own length on the type and 0.367 on the dissected specimen. The carpocerite exceeds the last antennular article by about the length of that segment on the type; on other specimens this may drop to about one-quarter of the length of the last segment and is 5.4 times as long as wide on the dissected specimen.

The outer distal border of the merus of the large chela bears a strong point. On the dissected specimen this segment is 3.32 times as long as wide. The proportions of the larger chela on the type are: fingers 1.0:total length 3.9:height 1.45; on the dissected specimen these ratios are: 1.0:4.05:1.48. The palm is armed anteriorly with a small tubercle tipped by a slender acute spine. The fixed finger is much reduced, there being practically no cutting edge beyond the socket receiving the plunger of the dactylus. The dactylus has not undergone a corresponding reduction, so considerably exceeds the fixed finger in length.

The merus of the smaller chela is unarmed and on the dissected specimen is 3.78 times as long as wide. On the same specimen the carpus is 0.52 times as long as the chela, on the type 0.532, and on another specimen 0.56. On the type the chela has the following proportions: finger 1.0:total length 2.58:height 0.8; on the dissected specimen these ratios are: 1.0:2.74:0.83. The dactylus terminates in two subequal teeth and bears a thick brush of hair on its upper surface.

On the dissected specimen the merus of the second pair is five times as long as wide. The carpus is divided into five segments. The first, second, third, fourth, and fifth carpal segments and the chela of the dissected specimen stand in the following ratio: 1.0: 0.29:0.29:0.29:0.57:1.47. The third leg of the dissected specimen has the merus unarmed and 3.94 times as long as wide. The carpus is 0.44 times as long as the merus, the propodus 0.83. The latter segment is 9.84 times as long as wide, its posterior margin armed with a series of five spinules and a pair at the distal end. The dactylus is 0.055 times as long as the merus and 2.6 times as long as wide at the base. The two hooks of the dactylus are parallel, the dorsal being the stronger.

All except the second abdominal pleura of the males end in a point on the ventral border.

The telson of the dissection specimen has the following proportions: length 1.4 times width of the anterior base, 4.65 times the posterior base. The anterior base is 3.33 times as wide as the posterior. The distance from the anterior pair of dorsal spines to the posterior margin is 0.715 times the telson length, from the posterior pair 0.46. The longer (inner) pair of apical spines is 0.172 times as long as the telson. The outer blade of the uropods bears from five to eight teeth with a movable spine between the last two.

REMARKS: *Synalpheus disparodigitus* is very similar to *S. pectiniger* Coutière which it resembles in the absence of the scale on the scaphocerite, the reduction of the fixed finger on the major chela, and in the toothed apex to the fingers of the small chela. It may be distinguished from that species by the following characters: (1) the dorsal prominence of the major chela which on *disparodigitus* consists of tubercle and small spine and on *pectiniger* is composed of a large, tapering, spine-like process; (2) the dactylus of the smaller chela which is bidentate on *disparodigitus* and tridentate on *pectiniger;* (3) the external blade of the uropods whose outer margin is armed with from five to eight spines on *disparodigitus* and, with the exception of the terminal spine, smooth and unarmed on *pectiniger.* *S. disparodigitus* is also similar to *longicarpus* (Herrick) which it resembles in the shape of the anterior margin of the carapace, the bidentate tip of the dactylus of the small chela, and the armed outer margin of the uropods. From *longicarpus, disparodigitus* is separated by the following features: (1) the lack of a scale on the scaphocerite on *disparodigitus,* present, at least, on the female of *longicarpus;* (2) the reduced fixed finger of the larger chela of *disparodigitus* which is normally developed on *longicarpus;* and (3) the narrower merus of the third leg, over three times as long as wide on *disparodigitus* and only a little over twice as long as wide on *longicarpus.*

Synalpheus barahonensis, new species

Figure 7

MATERIAL: Holotype, one male, A.M.N.H. No. 9578, carapace length 3.2 mm.; paratypes: one female, A.M.N.H. No. 9579, carapace length 3.6 mm.; dissected specimen, one male, A.M.N.H. No. 9580. All are from a live colony of *Agaricia agaricites* (Linnaeus) behind Piedra Prieta Reef.

The rostrum, 1.2 times as long as wide on the type, is equal in length to the orbital spines and falls short of the end of the first antennular article by 3.84 times its own length on the same specimen. The orbital spines are 0.6 times as long as wide on the type.

The first, second, and third antennular articles on the male paratype stand in the following ratio: 3.0:1.0:1.0. The second and third articles are both as long as wide at their distal extremities on the male paratype. The stylocerite falls short of the end of the first antennular article by 0.22 of the length of that segment on the male paratype.

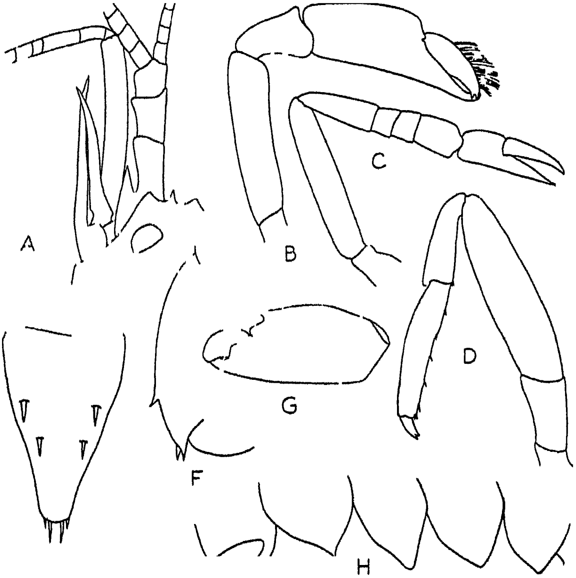

Fig. 7 *Synalpheus barahonensis*, new species. A. Frontal and antennal structures. B. Small chela. C. Second leg. D. Third leg. E. Telson. F. Outer margin of uropod. G. Large chela. H. Pleura.

The upper angle of the basicerite is very nearly a right angle. Its lateral spine reaches to the proximal third of the terminal antennular article on the type and to the end of the second antennular article on the male paratype. The scaphocerite lacks the scale on both sexes and very slightly exceeds the lateral spine of basicerite on all three specimens. The carpocerite exceeds the antennular peduncle by 0.66 of the length of the terminal article on the type, by the entire length of that article on the male paratype, and is 6.67 times as long as wide on the male paratype.

The third maxillipeds lack any trace of the circlet of spines which usually crowns the tip of the ultimate article in *Synalpheus*.

The outer distal margin of the merus of the larger chela is rounded. On the male paratype this segment is 2.25 times as long as wide. The proportions of the larger chela on the type are: fingers 1.0:total length 3.33:height 1.42. On the male paratype these ratios are: 1.0:3.6:1.5. The anterior prominence of the palm is conical, not spined.

The merus of the small chela is unarmed and on the male paratype 4.3 times as long as wide. On the same specimen the carpus is 0.41 times as long as the chela, on the type 4.15, and on the paratype 4.9. The relative proportions of the chela on the type are: fingers 1.0:total length 2.42:height 0.75. On the male paratype these ratios are: 1.0:2.5:0.77. The dactylus terminates in two subequal teeth and bears a thick brush of hair on its upper surface.

On the male paratype the merus of the second leg is 5.8 times as long as wide. The carpus is divided into four segments. On the male paratype the first, second, third, and fourth carpal segments and the chela stand in the following ratio: 1.0:0.27:0.23:0.5:1.33.

The third leg of the male paratype has the merus unarmed and 3.75 times as long as wide. The carpus is 0.4 times as long as the merus. The propodus, 0.732 times as long as the merus, is 5.5 times as long as wide, its posterior margin armed with a series of five spinules and a pair at the distal end. The dactylus is 0.106 times as long as the merus and 1.6 times as long as wide at the base. The two hooks of the dactylus are equal and parallel.

The abdominal pleura of the males end in a point on the ventral border; those of the female are rounded.

The telson of the paratype has the following proportions: length 1.55 times the width of the anterior base, 5.81 times the width of the posterior base. The anterior base is 3.74 times as wide as the posterior. The distance from the anterior pair of dorsal spines to the posterior margin is 0.65 times the length of the telson, from the posterior pair 0.457. The longer (inner) pair of apical spines is 0.143 times as long as the telson length. The outer blade of the uropod bears two or three teeth with a movable spine between the last two.

REMARKS: *Synalpheus barahonensis* is similar to *S. rathbunae*

Coutière which it resembles in absence of the scale on the scaphocerite, the four-segmented carpus of the second leg, and a similar armature of the outer blade of the uropods. It may be distinguished from that species by the following characters: (1) the upper angle of the basicerite which is truncate on *barahonensis* and produced into a strong spine on *rathbunae;* (2) the third maxillipeds which lack the circlet of spines at the tip of the last segment, which are well developed on *rathbunae* and, as far as I am aware, on every other described species of the genus; and (3) by the much narrower merus of the third leg, 3.7 times as long as wide on *barahonensis* and only 2.2 on *rathbunae.*

Synalpheus dominicensis, new species

Figure 8

MATERIAL: Holotype, one female, A.M.N.H. No. 9581, carapace 3.3. mm. long, from quiet water inside Piedra Prieta Reef; paratype (dissected specimen), one female, A.M.N.H. No. 9582, carapace 2.8 mm. long, dredged just outside Yuncu Pass in about 2 to 1 fathoms.

DESCRIPTION: The rostrum, 4.4 times as long as wide on the holotype, 5.56 on the paratype, falls just short of the second antennular segment on the type and just reaches that article on the paratype. The orbital hoods are tipped with slender acuminate spines which fall short of the end of the rostrum by 0.288 of the latter's length on the holotype and 0.258 on the paratype.

The first, second, and third antennular segments stand in the following ratio on the paratype: 3.0:1.0:1.0. The second and third articles are both as long as wide at the distal end of the paratype. The stylocerite falls a little short of the middle of the second antennular article on the holotype and reaches the middle on the paratype.

The upper angle of the basicerite is produced into a strong spine that on the type reaches about halfway from the end of the orbital spine to the end of the first antennular article. The lateral spine of the scaphocerite exceeds the terminal antennular article by about the length of that article on the type. A scale is present in both sexes, about equal in length to the carpocerite on the holotype and only reaching to about the middle of the terminal antennular segment on the dissected specimen. The carpocerite is about equal in length to the antennular peduncle on both specimens; on the paratype it is 4.6 times as long as wide.

The outer distal margin of the merus of the larger chela is armed with a strong spine and is two times as long as wide on the paratype. The proportions of the larger chela on the type are: fingers 1.0:total length 2.64:height 0.91. On the paratype these ratios are: 1.0:2.82:1.0. The anterior prominence has the form of a strong, curved, sharp spine, the point of which is directed forward.

The merus of the small chela of the type is armed with a strong spine on the outer distal margin and is 2.56 times as long as wide.

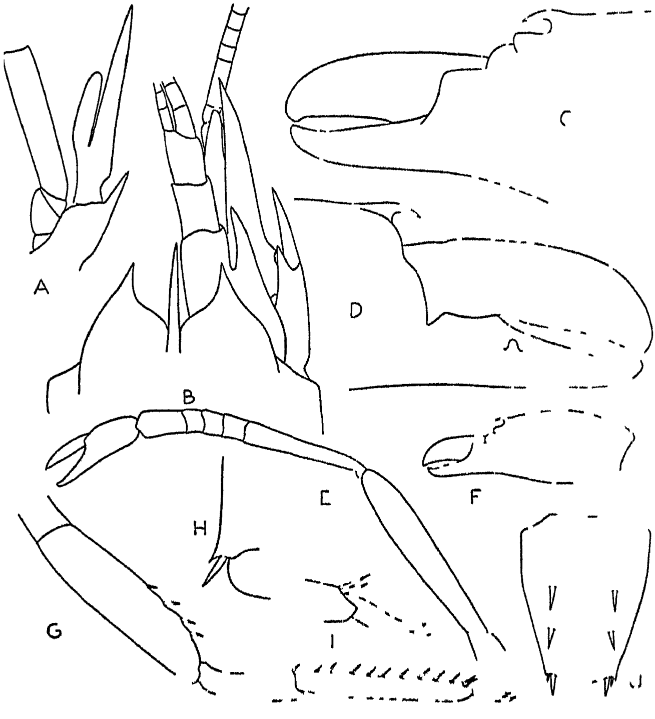

FIG. 8. *Synalpheus dominicensis*, new species. A. Peduncle of second antenna. B. Frontal and antennular structures. C. Distal portion of large chela, upper side. D. Distal portion of large chela, lower side. E. Second leg. F. Large chela. G. Third leg. H. Outer margin of uropod. I. Dactyl of third leg. J. Telson.

On the same specimen the carpus is 0.32 times as long as the chela. The relative proportions of the chela are: fingers 1.0:total length 2.68:height 0.915. The dactylus terminates in two teeth, the anterior one of which is the larger. There is no brush of hair on the upper surface.

On the paratype the merus of the second leg is 6.1 times as long as wide. The carpus is divided into five segments. On the paratype the first, second, third, fourth, and fifth carpal segments and the chela stand in the following ratio: 1.0:0.28:0.187:0.167: 0.396:0.795.

The merus of the third leg is armed with four movable spines on the distal half of the lower margin and on the paratype is 3.5 times as long as wide. The carpus is 0.5 times as long as the merus. The propodus, equal in length to the merus, is seven times as long as wide and bears nine spines on the lower border in addition to the pair at the distal end. The dactylus is 0.24 times as long as the merus and 3.4 times as long as wide at the base. The ventral hook is wider than the dorsal, to which it is parallel.

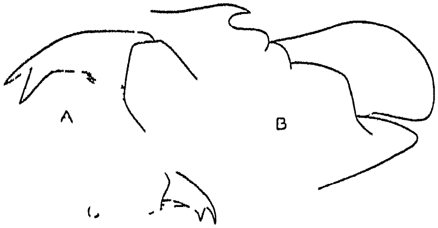

FIG. 9. Species of *Synalpheus*. A. Dactylus of third leg of *Synalpheus streptodactylus*. B. Fingers of the larger chela of the first pair of *Synalpheus streptodactylus*. C. Dactylus of the third leg of *Synalpheus ancistrorynchus*.

Both specimens are females and have the abdominal pleura rounded. On the type the telson has the following proportions: length 1.3 times the width of the anterior base, 2.5 times the length of the posterior base. The distance from the anterior pair of dorsal spines to the posterior margin is 0.585 times the length of the telson, from the posterior pair 0.308. The inner pair of apical spines is the longer and is 0.143 times as long as the telson. The outer blade of the uropods bears a single tooth and a movable spine just below it.

REMARKS: *Synalpheus dominicensis* appears allied to both the *neomeris* and the *paulsoni* groups. It is distinguished from all the American species of both groups by the row of spines on the distal portion of the posterior margin of the third legs, this segment being smooth and unarmed on previously described American species. In the *neomeris* group it most closely resembles *S. streptodactylus* Coutière, in the *paulsoni* group *ancistrorynchus*, both from the

Indo-Pacific. From these *dominicensis* is separated by the shape of the dactylus on the third leg. Dactyls from the Philippine specimens of these species in the collections of the American Museum of Natural History have been figured for comparison in figure 9A, C. From *streptodactylus* it is also distinguished by the very different shape of the fingers of the larger chela (figs. 8C, D, 9B) and the longer length of the latter, 2.64 times the total length on *dominicensis* as against 3.6 on our specimen of *streptodactylus*. From *ancistrorynchus* it may further be distinguished by the shape of the frontal margin of the carapace. On *dominicensis* the margin of the median side of the orbital lobes meets the rostrum at a very acute angle, and the latter arises so sharply from that point that it appears to originate some distance in from the frontal margin. On *ancistrorynchus*, on the other hand, the spaces between the median margins of the orbital lobes and the rostrum are nearly U-shaped, and the rostrum appears to spring from the very edge of the frontal margin.

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NEW GENERA AND SPECIES OF HALACARIDAE (ACARI)

BY IRWIN M. NEWELL[1]

The Halacaridae of the eastern North Pacific are virtually unknown at the present time, except for three species described from Laguna Beach, California, by H. V. M. Hall (1912). These were very inadequately treated and only two of them have been identified by the writer in collections from the type locality, namely, *Copidognathus curtus* Hall, 1912, and *Agaue californicus* (Hall), 1912 (= *Copidognathus californicus* Hall). The third species, *Pontacarus californicus* Hall, 1912, is still unknown and may even be one of the species of *Rhombognathus* so abundant at Laguna Beach. The present paper describes three new species from the Pacific coast, all of which are unusual in a number of respects, and one of them is the type of a new genus, *Thalassacarus*, closely related to *Thalassarachna* Packard, 1871. The remaining two are representatives of established genera, *Agaue* Lohmann, 1889, and *Copidognathus* Trouessart, 1888.

In addition to the above new genus and species, additional notes are provided on two other genera, *Thalassarachna* Packard, 1871, and *Anomalohalacarus*, new genus. The validity of Verrill's *Thalassarachna* was established during the course of studies on the marine Halacaridae of eastern North America (Newell, 1945, 1947a), but at that time the writer retained it as a subgenus of *Halacarus* Gosse, 1855. It is now my belief that it should be regarded as a distinct genus since the species of the two groups differ consistently in several important respects. In addition the new genus *Anomalohalacarus* is established here for *Halacarus anomalus* Trouessart, 1894. *Anomalohalacarus* is not known from the North Pacific at present.

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The figures were drawn by the author with the aid of a camera lucida. Scales are available for all figures, and these can be used to obtain measurements not given in the text. Each subdivision of the scale equals 10 μ, so that a scale with one division represents 10 μ, one with three divisions represents 30 μ, etc. In the scales that are 10 divisions long, a slightly longer mark has been made at the 50 μ point.

The standard abbreviations used in the monograph on the Halacaridae of eastern North America are used here for the following frequently recurring terms:

AD, anterodorsal plate
AE, anterior epimeral plate
GA, genito-anal plate
OC, ocular plate
P-3, palpal segment three
PD, posterodorsal plate
PE, posterior epimeral plate
I-6, segment six of leg I (or tarsus I)
III-3, segment three of leg III (or femur III)

The holotypes and some of the paratypes are deposited in the collection of the American Museum of Natural History.

THALASSACARUS, NEW GENUS

DIAGNOSIS: Palpi lateral in position, four-segmented, P-2 with a distidorsal seta, and P-3 bearing a dorsomedial seta as in *Thalassarachna*. P-4 with three large setae on the proximal half (fig. 15). Chelicera with a heavy dentate basal process. Bacillum of tarsus I on the lateral membrane of the claw fossa, that of tarsus II on the medial membrane (figs. 20, 21). Five pairs of setae in the dorsal body series (fig. 5). Genital sclerites of female without setae (fig. 4), adanal setae ventrolateral to anal papilla (figs. 1, 12).

GENOTYPE: *Thalassacarus commatops*, new species.

REMARKS: This genus falls in the subfamily Halacarinae Viets, 1927, and keys out to *Thalassarachna* in the author's key (Newell, 1947a, p. 22). It is nearest *Thalassarachna* but differs from all species of that genus in the form of the chelicerae, the ventrolateral position of the adanal setae, the absence of setae on the genital sclerites of the female, and the possession of rosette pores. *Thalassacarus* differs from *Copidognathus* in the seta on

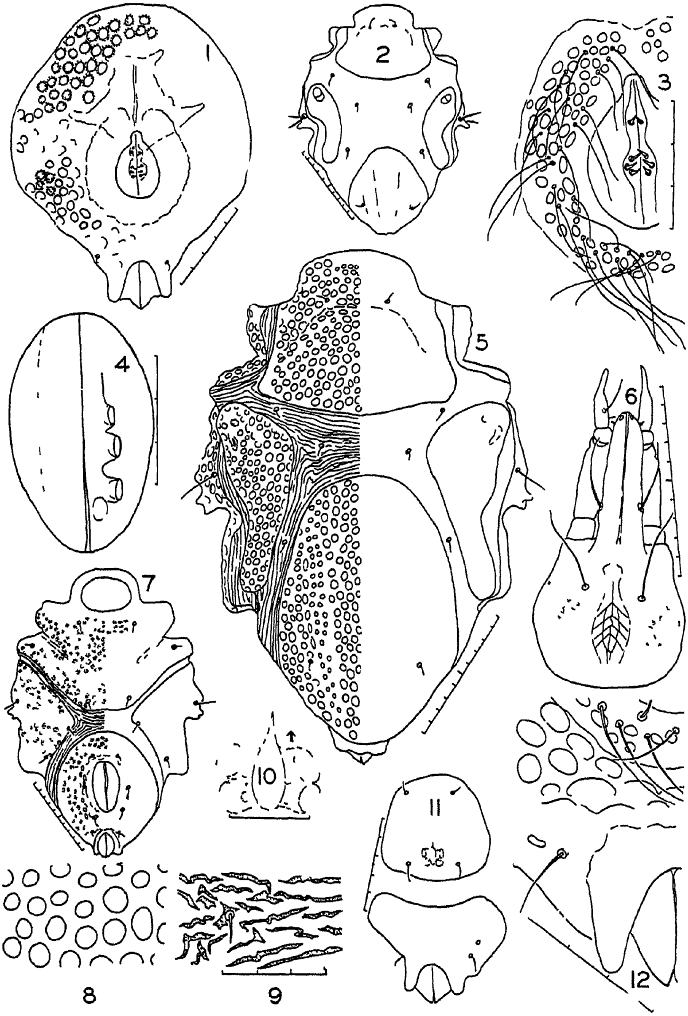
P-3, the disposition of the setae on the base of P-4, the form of the chelicera, the position of the bacillum (lateral on both tarsi I and II in *Copidognathus*), the absence of setae on the genital sclerites, the position of the adanal setae, and the chaetotaxy of I-5 and II-5. The similarity of the new genus to *Copidognathus* is largely superficial.

Thalassacarus commatops, new species

Figures 1–26

FEMALE: Body 344–378 μ long, 270–280 μ wide, length/width = 1.36–1.46; average 369.2 by 277.7 μ, length/width = 1.36 (based on one specimen from Pacific Grove and five from Laguna Beach, California). AD (fig. 5) uniformly convex along posterior margin, or irregularly convex as shown in the figure. Central portion of posterior half of AD forming an elevation rising above the level of the remainder of the plate, the single pair of setae lying at the anterior margin on the elevated portion. Rosette pores and porose areas lacking, entire plate rather uniformly marked with coarse, deep pits (fig. 8) which are variable in size on different parts of the plate. OC (fig. 5) of unusual form, with a heavy caudiform projection, reaching very nearly to insertion of leg IV; anterior cornea distinct, circular, posterior cornea less distinct. Elongate PD with only a single pair of setae (the fourth pair of dorsal setae lies in the membranous area between PD and OC). Membranous area mostly thick, parallel striae which anastamose occasionally and which are strongly wrinkled in the region of the third dorsal setae (fig. 9).

AE (fig. 7) with porose panels at the center of the plate which become markedly depressed towards the edge of AE and approach rosette pores in appearance. There is no pronounced ostium but only a deep pit of seemingly uniform diameter throughout its depth. A separate transverse band about equal in width to three porose panels lies between the first pair of setae of AE (fig. 7). PE with three setae ventrally, one dorsally, unpanelled areas as shown in figure. GA ovate, three pairs of setae by genital opening, and a fourth (adanal) pair lateral to the anal papilla and visible only in ventral view (fig. 12, male). These are the homologues of the setae that lie dorsal to the anus in species of *Thalassarachna*. Lateral limit of genital sclerite indistinct (fig. 4, right side), light sclerotization extending to sides



FIGS. 1–12. *Thalassacarus commatops*, new species. 1. Male, genito-anal plate. 2. Deutonymph, dorsum. 3. Male, genital area. 4. Female, genital opening. 5. Female, dorsum. 6. Female, capitulum, ventral view. 7 Female, venter. 8. Female, cuticle near middle of left posterior quarter. 9. Female, dorsal membranous area around third dorsal seta. The stippled areas are depressed. 10 Deutonymph, genital area. 11. Deutonymph, genito-anal area. 12. Male, posterior tip of GA.

of genital opening. Three pairs of genital suckers present (fig. 4 left side). No setae on genital sclerites.

Rostrum (fig. 6) nearly parallel sided, reaching well beyond P-3; a pair of small spine-like setae near tip (fig. 13), and a barb-like structure (oil immersion) on the lateral convexity of the tip. Base of capitulum with depressed porose panels or rosette pores ventrally and dorsally. Pharyngeal plate and two pairs of large setae as shown. Palp (fig. 15) four-segmented, with a single seta distidorsally on P-2, a dorsomedial seta on P-3, three large setae on the basal half of P-4, and a very fine seta on the distal half. Chelicerae with distal half long and slender, gently bowed, movable digit of very unusual form, with two heavy basidorsal hooks, remainder of dorsal edge minutely serrate (fig. 14). The general form of the chelicera is roughly comparable to that of *Halacarus ctenopus* Gosse, 1855, except that the shaft in *Thalassacarus commatops* is more bowed (material not available for illustration of entire chelicera), and of course *H. ctenopus* does not have the hooks on the digitus mobilis. No cheliceral membrane.

CHAETOTAXY OF LEGS

	I				II				III				IV			
	d.	v.	l.	m.	d.	v.	l.	m.	d.	v.	l.	m.	d.	v.	l.	m.
1	—	—	—	1	—	—	—	1	1	1	—	—	—	—	—	—
2	1	1	—	—	1	1	1	—	1	1	—	—	1	1	—	—
3	4	1	—	—	3	1	1	—	2	1	—	—	2	1	—	—
4	3	1	—	1	3	1	1	—	2	1	—	—	2	1	—	—
5	5	1	—	1	4	1	1	1	3	2	—	—	3	2	—	—
6[a]	3	9	—	—	3	4	—	—	3	—	—	—	3	—	—	—

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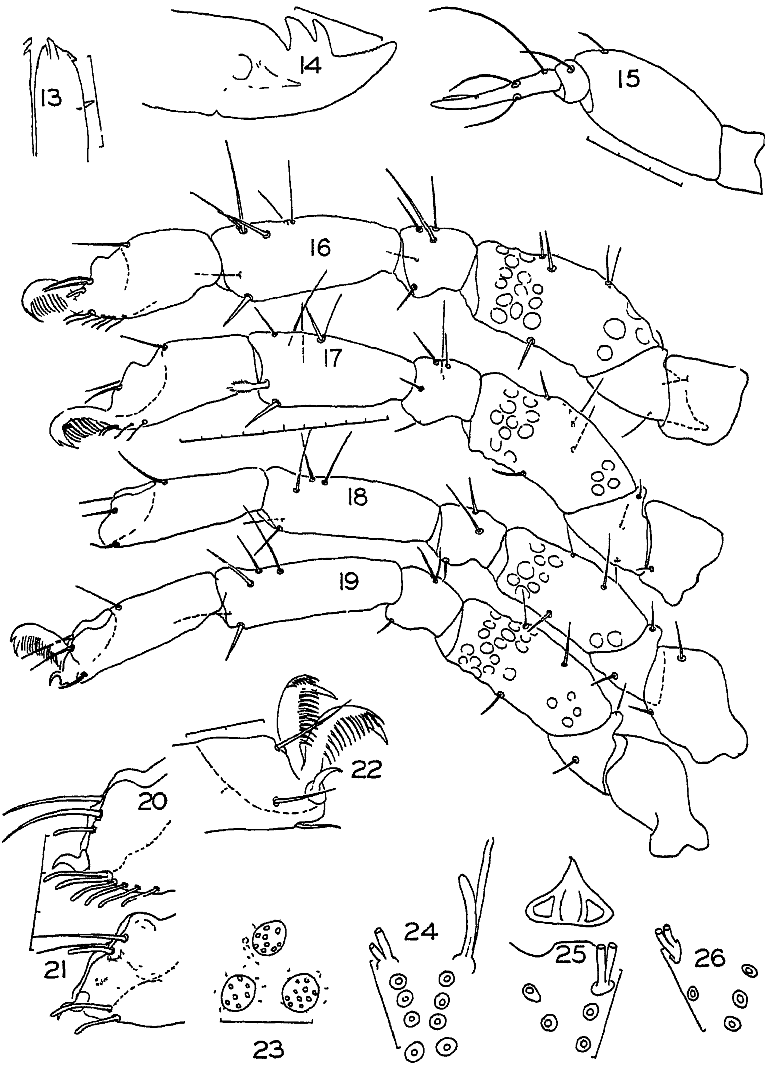
[a] These figures do not include the bacillum nor the parambulacral setae at the distal extremity of the tarsus. These are discussed separately in the text.

Setae of legs relatively short and showing many unusual characteristics. I-5 and II-5 with five setae dorsally, one ventrally and one medially, the latter being smooth on I-5 and pectinate on II-5. In addition to the three dorsal and nine ventral setae shown in the table for I-6, there is a bacillum on the lateral membrane of the claw fossa. Ventrally on I-6 there is a single seta about the middle of the segment, and more distally (figs. 20, 24) four pairs of curved bacilliform setae, and finally a pair of divaricate parambulacral setae on the tip of the tarsus. II-2 with a lateral seta (not present on I-2). II-6 with three



FIGS. 13–26. *Thalassacarus commatops*, new species. 13. Female, tip of rostrum, ventral view. 14. Female, chelicera. 15. Female, palp, medial view. 16. Female, leg I, lateral view. 17. Female, leg II, lateral view. 18. Female, leg III, lateral view. 19. Female, leg IV, lateral view. 20. Female, I-6, lateral view, lateral claws omitted. 21. Female, I-6, medial view, lateral claws omitted. 22. Female, III-6, ventromedial view. 23. Female, pores of AE, near leg I. 24. Male, I-6, ventral view of tip of I-6 of left side, showing chaetotaxy. 25. Female, II-6, ventral view of tip of II-6 of left side, showing normal chaetotaxy. 26. Female, II-6, ventral view of tip of II-6 of right side, showing exceptional chaetotaxy.

dorsal and three ventral setae in addition to the bacillum and parambulacral setae. The bacillum is on the medial membrane of the claw fossa rather than the lateral as is the case on I-6. Furthermore, a divaricate parambulacral seta is present only on the lateral side of the tarsus, the seta in the corresponding position on the medial side being single. In addition to the parambulacral setae there are three bacilliform setae just proximal to these, two lateral and one medial in position (fig. 25).[1] In one female (fig. 26) there were three setae medially and only one laterally behind the divaricate seta, but the other tarsus II was normal. Chaetotaxy of III and IV alike except for the trochanter (first free segment), which bears two setae on III, but none on IV. II-6 and III-6 each with a pair of simple parambulacral setae distally (fig. 22).

MALE: Body 338–358 μ long, 243–263 μ wide, length/width = 1.33–1.42; average 348.6 by 252.5 μ, length/width = 1.38 (based on four specimens from Laguna Beach, California). A single male from Yaquina Head, Oregon, was 385 by 280 μ, length/width= 1.38; or somewhat larger than the California females measured. Morphologically identical with female in all points mentioned above except characters of GA (figs. 1, 3). GA of same general outline as that of female, but rosette pores in three groups, a crescentic group anterior to the genital opening, and one group on either side of the opening. The number of pores varies greatly even in males from Laguna Beach, the male from which figure 1 was drawn having only four or five pores in the posterior groups, and about 75 in the anterior group, whereas in another male there are 15 to 18 and more than 100, respectively. The pores are of the type shown in figure 23. In the posterior groups there are a number of coarse, deep pits in addition to the rosette pores, and the remainder of the plate is smooth or irregularly roughened. Genital opening somewhat elevated above surface of plate, surrounded by a ring of deep pits and about 50 setae which are interrupted only anteriorly (fig. 3). Genital slit guarded by four (or five?) pairs of setae as shown. The most careful search of all available males showed no more than four pairs as indicated in the figure, but in some of these there was an additional alveolus-like structure associated with the anterior setae suggesting possibility of a minute fifth pair. Three pairs of internal genital suckers. Adanal setae as shown in figure 12, lateral to anal papilla, and visible only in ventral view.

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[1] This is not the only interpretation available here, since it is possible that neither of the two medial setae represents the parambulacral seta, and that the latter is therefore absent. Or it is also possible that the homologues of the two elements which make up the divaricate seta of the lateral side have become separated and are now represented by two single setae But either one of these alternatives would be more exceptional than the one given above.

DEUTONYMPH: Easily recognized by form of OC (fig. 2). Dorsal membranous area with thick, wrinkled striae (as in fig. 9, female); striae of ventral membranous area more uniformly parallel, but chaetography virtually identical with that of adult except for genito-anal region. Genital and anal areas (fig. 11) completely separated by striate cuticle. Genital plate with four setae; subgenital setae not found, but probably present. The four small circles in figure 10 represent refractile spots which may be the alveoli of four subgenital setae, but, if so, then these project into the subgenital chamber and do not project from the surface of the plate.

REMARKS: When first seen, this small species presents the general facies of a *Copidognathus*, a resemblance which is completely belied by a close morphological study. The form of the depressed porose panels (or rosette pores) demonstrates the impossibility of drawing a sharp distinction between these two types of structures, for the pores in this species are intermediate in form to the typical porose panels and rosette pores, although for the most part they more nearly approach the latter. The presence of this species at Laguna Beach, California, the type locality of *Copidognathus curtus* Hall, 1912, requires consideration of the possibility of identity of the two forms. This will not be presented here because a troublesome point in variation must be resolved before Hall's species can be fully clarified. The writer is certain that *Copidognathus curtus* is a true *Copidognathus*, and that it is by far the most common species of the genus at Laguna Beach. However, I have seen the species in collections ranging from Mexico to Oregon, and it is quite variable in its morphology throughout this range.

DISTRIBUTION: Oregon: Yaquina Head, male holotype (44° 41′ N., 124° 06′ W.), I. M. Newell. California: Crescent City (41° 45′ N., 124° 11′ W.), Leroy E. Detling; Pacific Grove (36°

39′ N., 121° 53′ W.), Borys Malkin; Laguna Beach (33° 35′ N., 117° 45′ W.), Borys Malkin.

Agaue bradypus, new species

Figures 27–47

FEMALE: Body 682 μ long, 365–385 μ wide, length/width = 1.77–1.88, based on only two specimens from Crescent City, California. AD with a thick layer[1] of cerotegument. Remainder of AD without cerotegument, but posterior half of plate with pores of moderate size (1 to 2 μ); one pair of large pores at the level of the setae. OC with two corneae, behind which lies a coarse pore. Entire surface of plate, including the corneae, minutely punctate; pores and setae as shown in figure 34. PD completely surrounded by membranous area, and bearing only the fifth pair of dorsal setae; costae absent, one pair of pores near posterior end. Dorsal plates unpanelled. Dorsal membranous area finely striate, the striae wrinkled but parallel and showing only occasional anastamoses. Striae distinct in clean, but indistinct in fouled, specimens. Second and fourth pairs of dorsal setae in membranous area.

AE (fig. 27) minutely punctate, three pairs of setae as shown. PE almost entirely ventral, separated medially by only a thin band of striate cuticle; five pairs of setae ventrally and three pairs dorsally, two of the latter just anterior to insertion of leg IV. Epimeral areas III and IV set off by slightly depressed groove, but not by striate cuticle. GA (fig. 33) acutely rounded anteriorly. Adanal setae dorsolateral on anal papilla. Genital opening surrounded by 16 to 18 setae. Genital sclerites feeble, three pairs of internal genital suckers, proximal end of ovipositor slightly anterior to margin of GA. Ventral plates showing weakly developed panels which are not excavated. Cerotegument on margins of AE and PE, and on anal papilla as shown in figures. Ventral membranous area greatly restricted, marked with delicate parallel striae.

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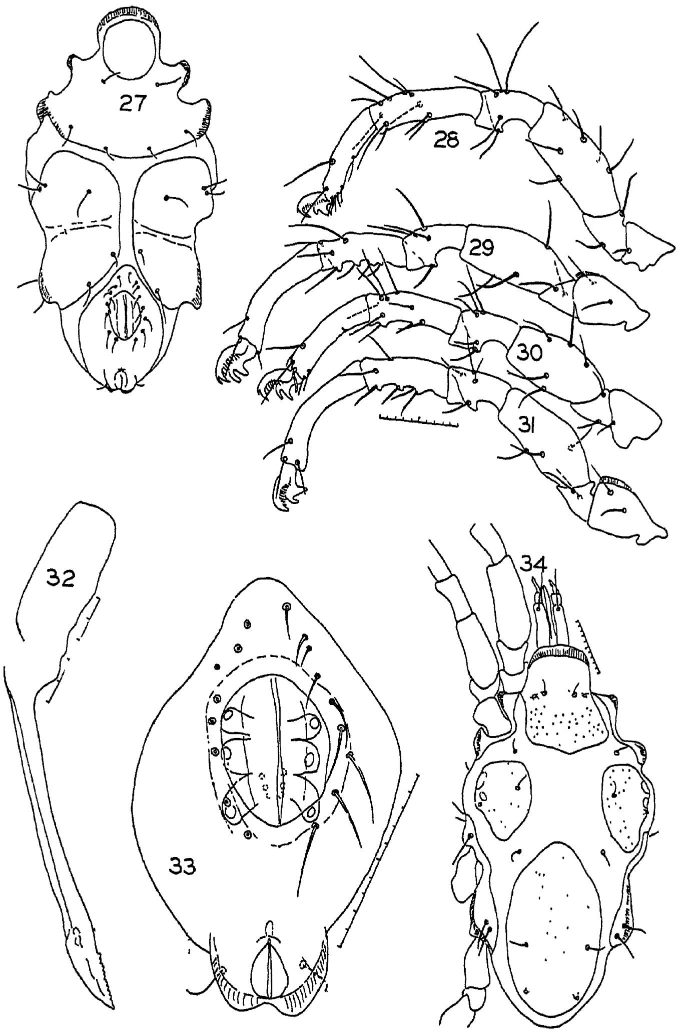
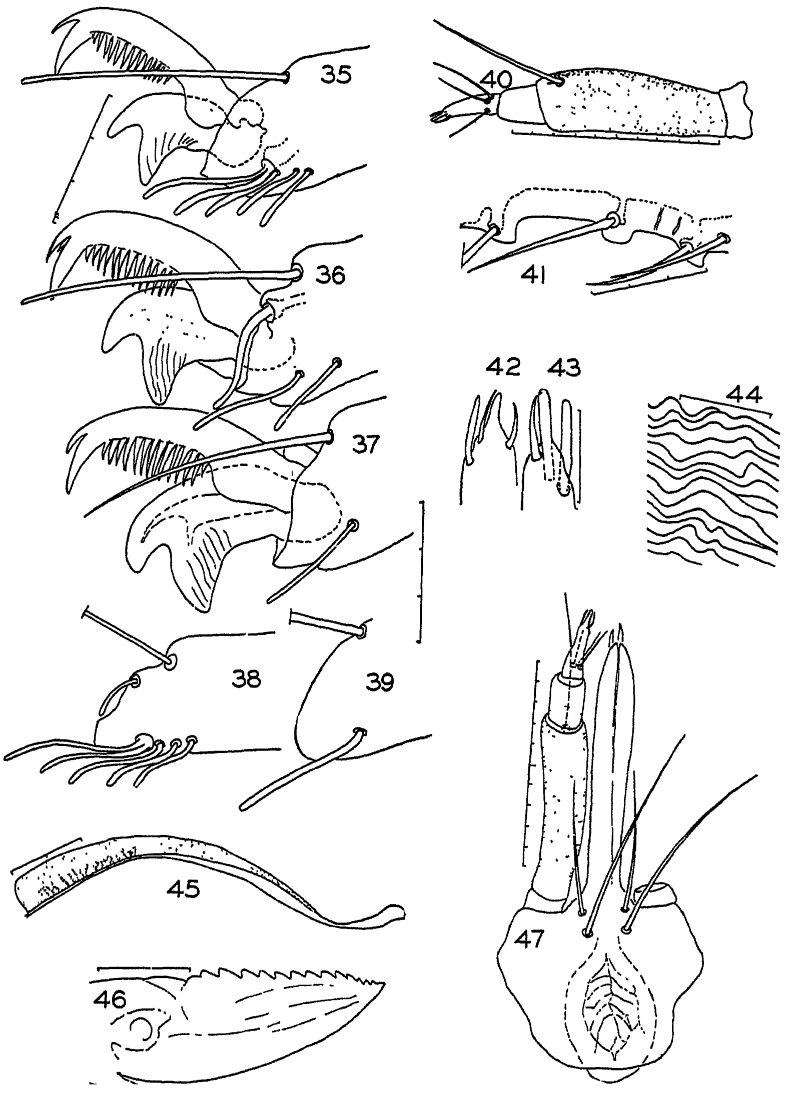
[1] This seems to be comparable with what Grandjean (1936a, p. 139; 1936b, p. 77; 1936c, p. 84) refers to as cerotegument in the Oribatoidea. Its finely branching internal structure and yellowish color give the distinct impression that this layer was laid down subsequent to the cuticle proper, through the extremely minute cuticular canals which are present on all plates. Material was not available to test for solubility in potassium hydroxide. Tests by the writer have shown the cerotegument in *Pelops* C. L. Koch, 1835, and other genera to be soluble in alkali.



FIGS. 27–34. *Agaue bradypus*, new species, female. 27. Venter, same scale as figure 34. 28. Leg I, medial view. 29. Leg III, lateral view. 30. Leg II, medial view. 31. Leg IV, lateral view. 32. Chelicera, medial view. 33. GA. 34. Dorsum.



FIGS. 35–47. *Agaue bradypus*, new species, female. 35. I-6, medial view. 36. II-6, medial view. 37. III-6, medial view. 38. I-6, lateral view, claws omitted. 39. II-6, lateral view, claws omitted. 40. Palp, medial view. 41. Ventral setae of IV-5, lateral view. 42. Distal end of P-4 of right side, ventral view. 43. Distal end of P-4, medial view. 44. Dorsal membranous area. 45. Optical section through dorsal wall of IV-1, showing cerotegument (stippled). 46. Chelicera, medial view. 47. Capitulum, ventral view.

Tips of palpi not quite reaching to end of I-3. P-2 porose, the pores of the same size as those on the dorsal plates. P-3 and P-4 combined 0.6 times as long as P-2. One large seta distidorsally on P-2, none on P-3, and three on the proximal half of P-4. Distal end of P-4 (figs. 42, 43) with three seta-like structures, the central one of which is very closely applied to the tip of the palp and therefore invisible in lateral view. Rostrum reaching beyond end of P-3, somewhat broader distally than near base. Base of capitulum minutely reticulate, two pairs of maxillary setae on the base of the capitulum. Pharyngeal plate greatly expanded (fig. 47). Chelicerae (figs. 32, 46) with a slender shaft that is much longer than the base. Cheliceral membrane absent, or at least not evident; digitus mobilis with 12 to 14 teeth.

Legs remarkably rigid, directed ventrally, and bowed, strongly suggestive of the legs of a sloth suspended from a limb of a tree. This, in combination with the enormously enlarged median claws provides the inspiration for the specific name.

CHAETOTAXY

	I				II				III				IV			
	d.	v.	l.	m.	d.	v.	l.	m.	d.	v.	l.	m.	d.	v.	l.	m.
1	—	—	—	1	—	—	—	1	1	—	1	—	1	—	1	—
2	1	1	—	—	1	1	—	—	—	—	1	1	—	—	1	1
3	4	1	—	1	3	2	1	—	1	2	—	—	1	2	—	—
4	3	2	—	—	3	2	—	—	1	1	1	1	1	1	1	1
5	4	4	2	—	3	4	2	—	2	4	1	—	2	4	1	—
6[a]	3	1	—	—	3	—	—	—	3	—	—	—	3	—	—	—

[a] Does not include the setae at the distiventral extremity, nor the bacillum. These are treated separately in the text.

I-6 (figs. 28, 35, 36) with three setae dorsally and one ventrally near middle, and in addition a bacillum on the lateral membrane; three pairs of bacilliform setae. II-6 (figs. 30, 36) with the characteristic three dorsal setae, but lacking the ventral seta near the middle of the segment (compare with I-6). Parambulacral setae not divaricate, but single. A bacilliform seta proximal to the medial parambulacral seta (fig. 36), but none found here in the corresponding position on the lateral side (fig. 39). Bacillum of II-6 on the medial membrane, much larger than that on I-6, and curved downward. III-1 and IV-1 with a small patch of cerotegument dorsally (figs. 29, 31). III-6 and

IV-6 with the usual three dorsal setae, and the single pair of parambulacral setae; bacillum absent. Tarsi II, III, and IV unusually sharply bent. Patella of all legs with ventral wall produced downward in such a way that the ventral margin appears sharply concave when seen in profile (figs. 28 to 31). Some of ventral setae on tibiae I–IV arising near or on heavy projections of the cuticle (fig. 41). Claw fossa very small, not adequate to enclose ambulacrum, lateral membranes small. Lateral claws pectinate, the pectinations readily visible at magnifications of 150 × or more. Accessory tooth present, distinct from rest of pecten, although it may contain two teeth. Median claw very heavy, brown in color, and ventral tooth striate. Cuticle of legs traversed by pores of moderate diameter (1–2 μ).

REMARKS: The clarity of the cuticular details of the mite varies considerably, apparently with age or degree of fouling with what is probably bacterial slime. In the older female of the two studied, it was difficult to make out either the margins of the plates or the striae of the membranous area. This same condition was observed in a nymph from Yaquina Head, Oregon, so that fouling of the cuticle is apparently common, if not characteristic of the species. Why most species of Halacaridae maintain a very clean cuticle while some do not is unknown. The cerotegument in this species does not form lamellae and sharp points as in *Agaue nationalis* Lohmann, 1893, but only low caps over certain portions of the body.

The form of the legs is so characteristic that the writer thought for some time that a new genus was involved, but as more detailed studies were made, it was found that this species differed in no significant way whatever from species of *Agaue* in regard to disposition of setae, form of chelicerae, palps, rostrum, and plates. In all such characters it proved to be a good *Agaue* species. The form of the legs appears to be a specific adaptation of some type.

This species is very closely related to *Agaue alberti antarctica* (Trouessart, 1907) with which it shares the following relatively unusual features: P-3 lacking a dorsal seta, tarsi bowed, median claw grossly thickened. These characters are found in *Agaue alberti alberti* (Trouessart) also, but the published descriptions of that species do not permit a comparison with the one described here. Judging from Trouessart's original description, *Agaue* *bradypus* differs from *Agaue alberti antarctica* in the form of the genital plate, the number and distribution of the setae around the genital opening, and the presence of cerotegument. Other differences are apparent, but Trouessart's figures were not sufficiently reliable to make detailed comparisons. They were obviously drawn from a badly compressed specimen, and are somewhat generalized.

DISTRIBUTION: Oregon: Yaquina Head (44° 41′ N., 124° 06′ W.), I. M. Newell. California: Crescent City, female holotype (41° 45′ N., 124° 11′ W.), Leroy E. Detling.

Copidognathus pseudosetosus, new species

Figures 48–63

The following description is based only on forms from St. Paul Island, Alaska.

FEMALE: Body 459–513 μ long, 304–344 μ wide, length/width =1.46–1.56, average 484.0 by 320.3 μ, length/width = 1.51 (10 specimens). AD (fig. 48) with a prominent frontal spine, variable in acuteness, but nearly always extending beyond the tip of the rostrum (fig. 51). Anterior porose area elongate, posterior areas generally separate, but occasionally coalesced (fig. 50). Setae anterior to posterior porose areas. Second pair of dorsal setae in OC, third pair in PD. Corneae normal, two pairs of porose areas on OC. Four rows of rosette pores on PD. All dorsal plates prominently panelled, the panels not subdivided, the dorsal edges of the walls between the panels often with tubercles (fig. 55). Rosette pores with large ostia but reduced canaliculi, structure sometimes obscure. The canaliculi of the rosette pores of PD open internally into a depression which underlies the external alveolus. Canaliculi frequently open into the floor of the alveolus. Membranous areas greatly reduced, the plates contiguous to a considerable extent and even overlapping. Only a few anastamosing striae between AD and PD.

AE and other ventral plates very unique and characteristic of the species, deeply panelled, and with several areas of rosette pores as shown in figure 60. Two pairs of porose areas ventrally on AE, PE, and GA. Panels weakly developed or absent in posterior third of middle of AE, replaced by coarse but simple pores. Ventrolateral portions of body with fovea-like depressions as outlined on the left side of the body in figure 60. Rosette pores with large ostia, canaliculi opening at various points over the entire floor of the alveolus. Figure 53 shows the appearance of the ventral plates from the inner surface of the cuticle. Membranous areas greatly restricted, plates almost entirely contiguous. Genital sclerites with a single pair of setae.

Rostrum not reaching to end of P-2, but chelicerae usually reaching beyond this point. Frontal process generally extending well beyond tip of rostrum (fig. 51). Only two pairs of maxillary setae present, the basal setae never triplicated as in the male (fig. 49). Base of the capitulum with large rosette pores reaching to sides of pharyngeal plate. Palpi (figs. 51, 62) unique in the genus in the possession of a distimedial spur (not a seta) on P-3 (fig. 62). Legs as described for male.

MALE: Resembling female in all respects except general size, maxillary setae, and structure of GA. Somewhat smaller than female, body 445–480 μ long, 287–314 μ wide, length/width = 1.47–160, average 461 by 300 μ, length/width = 1.54 (10 specimens). GA (fig. 52) with two areas of rosette pores as in female. Genital opening (fig. 63) surrounded by about 30 setae. Cuticle deeply panelled. A hyaline shelf projects beyond the surface of the body, just behind the genital opening. The panelling enclosed within the outline of the shelf in figure 63 is not on the shelf itself, which is completely smooth, but on the wall of GA dorsal to the projection. Genital sclerites with the usual four pairs of setae which are characteristic of the genus.

Capitulum with three pairs of maxillary setae on the base of the capitulum (fig. 49), rather than one as in the female. One specimen had three basal setae on one side, but two on the other, while another had three basal setae on one side but four on the other. Three pairs of setae on the base of the capitulum are, however, the normal number.

In a male of unknown body length the following measurements were obtained (for I-3, I-5, II-3, II-5 the height, exclusive of the ventral lamella, is also given):

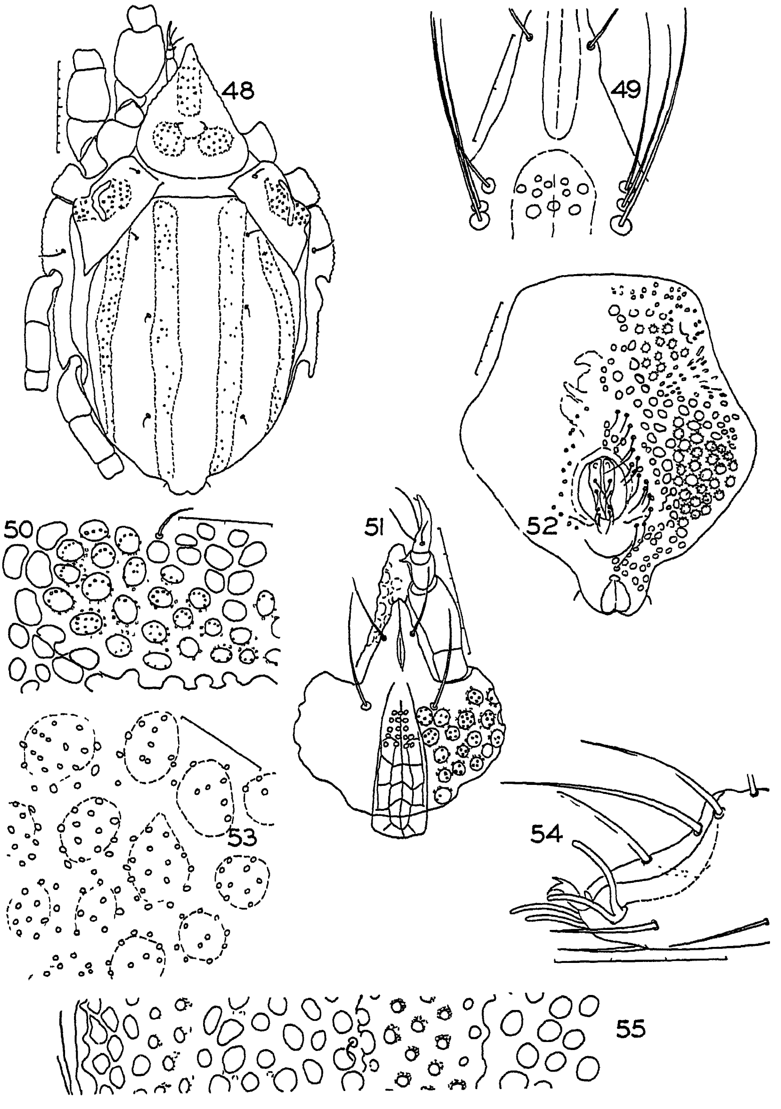
	1 + 2	3	4	5	6	Ambulacrum	Total
I	58 μ	82/60	27	79/41	53	28	323
II	58	69/49	26	64/38	61	31	309
III	72	58	23	66	72	31	322
IV	75	60	22	66	77	35	335

Chaetotaxy

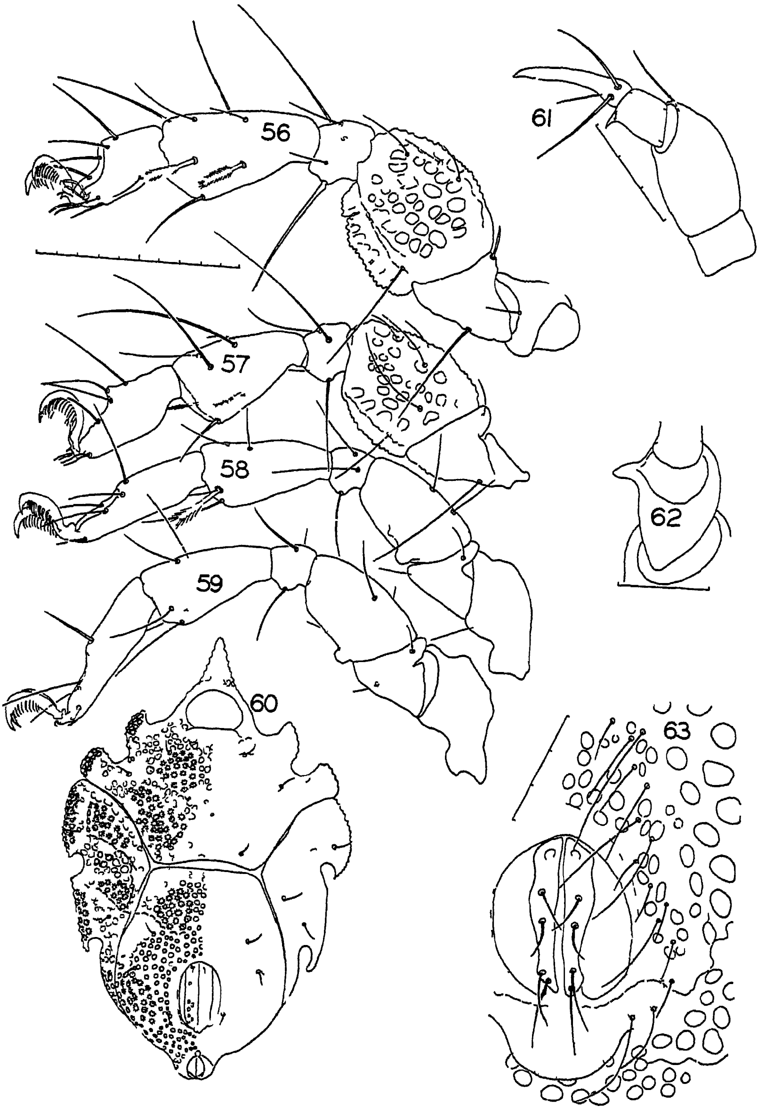
	I				II				III				IV			
	d.	v.	l.	m.	d.	v.	l.	m.	d.	v.	l.	m.	d.	v.	l.	m.
1	—	—	—	1	—	—	—	1	—	1	—	—	—	—	—	—
2	1	1	—	1	1	1	—	—	1	1	—	—	1	1	—	—
3	3	1	1	—	3	1	1	—	2	—	—	—	2	1	—	—
4	2	2	—	—	2	2	—	—	1	1	1	—	2	1	—	—
5	4	1	—	2	4	1	—	2	2	3	—	—	2	1	1	1
6	3	3	—	—	3	—	—	—	4	—	—	—	3	—	—	—

Leg I (fig. 56) when naturally extended, about 0.52–0.57 times as long as body (three specimens). Femora I and II swollen, 1.47 and 1.41 times as long as high, not including the ventral lamella, deeply panelled, without rosette pores or porose panels. Remainder of segments of legs I and II with minute panels, reticulate in appearance (650 ×). Ventromedial setae of I-5 and II-5 flattened, pectinate (oil immersion). I-6 (fig. 54) with three setae dorsally and three ventrally in addition to the divaricate parambulacral setae and the bacillum. Bacillum lateral in position. II-6 (fig. 57) lacking the three ventral setae, otherwise similar to I-6 in chaetography. III-5 with medial member of distiventral groups pectinate, the others smooth, all three distiventral setae of IV-5 smooth. III-6 with four setae dorsally, IV-6 with three. III-6 with parambulacral setae not divaricate, but single, greatly reduced, the medial member of the pair usually simple, setiform, the lateral member evidently broad, palmate, but impossible to delineate even under oil immersion. Both members of this pair are palmate on IV-6, and in one male both members on III-6 of the right side were apparently palmate. III-3 and IV-3 with a ventral tuberosity near the base (variable?), easily seen in lateral view but not in ventral view. Both III-6 and IV-6 lack ventral setae (excluding the parambulacral setae). Panelling on legs III and IV similar to that on I and II, but less prominent. All tarsi with claw fossa and membranes, all claws distinctly pectinate but with no real accessory tooth. An apparent accessory tooth is visible on claws viewed from the ventral side but is not seen in lateral view. Median claw very small, slender, especially on III and IV.

Remarks: Although there is no question of this species being a *Copidognathus*, there are a number of features which have not been observed heretofore in other species, notably the extreme development of rosette pores, the prominent frontal process of



FIGS. 48–55. *Copidognathus pseudosetosus*, new species. 48. Female, dorsum. 49. Male, capitulum, ventral view. 50. Female, left posterior porose area, and a portion of the right, from a specimen in which the posterior porose areas are coalesced. 51. Female, capitulum, ventral view. 52. Male, GA. 53. Male, internal surface of PE. Ostia of rosette pores (external surface) shown by dashed lines. 54. Male, I-6, medial view, lateral claws omitted. 55. Female, PD at level of left fourth dorsal seta, same scale as figure 63.



FIGS. 56–63. *Copidognathus pseudosetosus*, new species 56 Male, leg I, medial view 57 Male, leg II, lateral view, II-1 missing 58 Male, leg III, medial view. 59 Male, leg IV, medial view 60 Female, venter, same scale as figure 48 61. Male, left palp, ventrolateral view 62. Male, left P-3, anteroventral view. 63 Male, genital area.

AD, the triplication of the basal pair of maxillary setae of the male, the spine on the medial surface of P-3, and the hyaline shelf behind the genital opening of the male. The features of the capitulum deserve particular note. When first seen under low magnification, the spine on P-3 bears a deceptive resemblance to a seta, such as is found in *Halacarus*, *Thalassarachna*, and *Agauopsis*, to mention a few examples. But when examined under oil immersion, it becomes evident that this is only a superficial resemblance. The spine is a simple continuation of the wall of P-3, and there is not the least suggestion of an alveolus. Furthermore it lies at the distal end of the segment, whereas the seta of P-3 in species of other genera lies somewhat proximal to this point. Of course it is not impossible that this spine is produced by the same cell which produces the shaft of the seta in other genera, for the present genus, *Copidognathus*, was almost certainly derived from forms which had a seta on P-3. Such a seta is present, for example, in *Agauopsis* which undoubtedly is more closely related to *Copidognathus* than to any other genus. It is not impossible that many species of *Copidognathus* possess a trichogen in P-3 with limited seta-forming potentialities. But since the true setae of mites, like those of insects, are probably developed by the interaction of two cells (a trichogen which produces the seta; a tormogen which produces the alveolus and alveolar membrane), the absence of the latter would inhibit the expression of the potentialities of the trichogen except in exceptional cases of which this species may be an example. The dual origin of the true setae of mites is strongly suggested by cases in which it is apparent that the tormogen is functional while the trichogen is lost or is nonfunctional. The hyaline rings characteristically found in the cuticle of species of *Orthohalarachne* Newell, for example (Newell, 1947b, pp. 253, 264, figs. 20, 42, 46, 62), give every indication, by their position, of being the result of residual tormogens, the associated trichogens having become inactive for one reason or another. A number of unusual structures of the cuticle of mites could probably be explained on the basis of atypical interaction of trichogens and their associated tormogens. It should be evident, too, that it is necessary to draw as sharp a line as possible between true setae and structures of similar form which may simply be atypical, or which have no relationship whatever to setae, but are just local projections of the cuticle.

The triplication of the basal maxillary setae (fig. 49) of the male is another unusual feature of this species. In the female there is a single pair of these on the base of the capitulum (fig. 51). In view of the variation pointed out in the diagnosis above, it is to be expected that in rare instances specimens will be found which have only two basal maxillary setae on each side, whereas others will be found which have four on each side. These would have no taxonomic significance, of course.

The species is immediately recognizable in all parts of its known range on the basis of the spine on P-3, the triplication of the basal maxillary setae of the male, the distribution of rosette pores on the ventral plates, and the chitinous shelf posterior to the male genital opening. Variations are noticeable, however, the forms from St. Paul Island being larger and more heavily panelled and sculptured. Also the cuticle is somewhat pigmented in the St. Paul forms, an unusual feature in *Copidognathus*, whereas it is essentially colorless in specimens from Oregon and northern California. The differences cannot be assigned any systematic significance, however, since they are just as likely due to ecological differences as to genetic differences. The following table indicates the magnitude of the size differences (the figures give the length in μ).

	St. Paul I., Alaska	Yaquina Head, Oregon	Winchester Bay, Oregon	Crescent City, California
Males	445–480 μ	338–344 μ	358–371 μ	344–358 μ
Number	10	3	4	2
Females	459–513 μ	338 μ	358–385 μ	385 μ
Number	10	1	5	1

The forms from Winchester Bay had very short frontal spines, not even reaching to the middle of P-2, whereas in the forms from St. Paul, Yaquina Head, and Crescent City, the spines reached to or beyond the end of P-2. The difference was very noticeable, and some 20 specimens from Winchester Bay were examined, so that the difference is also statistically significant. It is impossible to say at present whether the difference is induced ecologically or genetically.

Distribution: Alaska: St. Paul Island, Bering Sea (57° 05′ N., 170° 25′ W.), male holotype, Victor B. Scheffer. Oregon: Yaquina Head (44° 41′ N., 124° 06′ W.), I. M. Newell; Winchester Bay (43° 40′ N., 124° 12′ W.), I. M. Newell. California:

Crescent City (41° 45′ N., 124° 11′ W.), Leroy E. Detling. The species did not appear in collections from Pacific Grove (36° 39′ N.), or at any point south of there.

THALASSARACHNA PACKARD, 1871

Further consideration of the characters of *Thalassarachna* Packard, 1871, leads the writer to believe that it should be considered a distinct genus rather than a subgenus of *Halacarus* Gosse, 1855. The important character of the shortened fourth segment of the legs is one that has never been shown to intergrade with the condition in *Halacarus* in which the third, fourth, and fifth segments are approximately equal. The presence of two setae on the second segment of the palp in *Halacarus* contrasted with the single seta found here in *Thalassarachna* is another character in which there appears to be no overlapping. Also the large pores of *Halacarus* surrounded by heavy chitinous rings, the striated cuticle covering the plates and legs, and the characteristic form of the genito-anal plate of the females are additional characters which clearly set off all or nearly all species of *Halacarus* from those of *Thalassarachna*. Accordingly the writer regards these two groups of species as discrete genera.

ANOMALOHALACARUS, NEW GENUS

Ever since its original description, *Halacarus anomalus* Trouessart, 1894, has been considered simply an aberrant species of *Halacarus*. However, it differs from species of *Halacarus* in so many respects that it seems unnatural to retain it in that genus. The following diagnosis appears to warrant separate generic status for this form: PD and AE divided into right and left halves. Palpi relatively straight, not geniculate, P-2 with no setae dorsally (Trouessart, 1894, pl. 10, showed a single seta dorsally, which requires verification), or at least without the two setae characteristic of *Halacarus*. PE with only the usual three ventral setae, the dorsal seta lying in the membranous area.

TYPE: *Anomalohalacarus anomalus* (Trouessart), 1894 (= *Halacarus anomalus* Trouessart, 1894).

REMARKS: *Anomalohalacarus*, new genus, differs from known species of *Halacarus* Gosse, 1855, in all of the characters listed above, and further studies will probably reveal others equally significant. One of these is the structure of GA, which may be almost entirely wanting in the new genus. In the female genital area (Newell, 1947a, p. 99, fig. 130) the genital opening is bordered by two large plates which are more likely enlarged genital sclerites rather than the rudiments of a divided genital plate as hitherto believed. The genital plate is probably represented by the small plate directly posteror to the genital opening.

Thus far the genus includes only the genotype, but the recognition of its true generic status, combined with more detailed descriptions of forms from all parts of the range of the genus, may result in the distinction of other species. *Anomalohalacarus* is known only from the North Atlantic at present, ranging from the English Channel into the North Sea and the Baltic, and from North Carolina to New Brunswick, but probably extends farther north.

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A NEW NAME FOR *BASILEUTERUS CULICIVORUS RORAIMAE* ZIMMER AND PHELPS

By John T. Zimmer and William H. Phelps

In their recent paper, "Four new subspecies of birds from Venezuela" (January 19, 1949, Amer. Mus. Novitates, no. 1395, p. 7), the authors inadvertently used the name "*roraimae*" for a new subspecies of *Basileuterus culicivorus*, overlooking the prior *Basileuterus roraimae* Sharpe (1885, Catalogue of the birds in the British Museum, vol. 10, p. 392). The error was discovered too late to permit correction before the publication of the paper in question.

Since the homonymy requires the proposal of a new name for the later-described bird, we suggest the following:

Basileuterus culicivorus segrex, new name for *Basileuterus culicivorus roraimae* Zimmer and Phelps, 1949, *loc. cit.*

In the same discussion, *B. c. olivaceus* should, of course, be corrected to read *B. c. olivascens*.